The Journal

OF THE

AMERICAN DENTAL ASSOCIATION

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SUGGESTIONS FOR THE TREATMENT OF ABNORMAL MOUTH HABITS

By GEORGE W. TEUSCHER,* M.A., D.D.S., M.S.D., Chicago, Ill.

BEFORE discussing the treatment of abnormal mouth habits, we might reasonably ask ourselves, "How prevalent are such habits in children, and why should we be concerned about them?" Swinehart, in writing about thumb-sucking, says:

> About two million children are born annually in the United States. It is well known that a large proportion of them form the habit during infancy. Most of these persist into early childhood, and some even into maturity.

Accurate studies showing the relationship of the various mouth habits to malocclusion are extremely few. Johnson recently studied a group of 989 children composed of 371 patients from private practice and 618 from the department of orthodontia of Northwestern University Dental School, only eight of them above 14 years of age. He found that 173, or 17.49 per cent, had sucked the thumb or fingers. Only three of the 173 showed no ill-effect, their thumb-sucking having been only occasional. This investigation is particularly impressive because of the large number of cases included and the infinite care taken in the diagnoses.

Few authors will deny the importance of habits in malocclusion. If one accepts Johnson's figures, one must admit the possibility of preventing, at least in part, approximately 18 per cent of all malocclusion through the control of mouth habits. This figure is large enough to command attention. Thumb-sucking, when done regularly, in many cases causes pronounced protrusion of the upper anterior teeth, and the abnormal force of the cheek muscles against the posterior teeth causes narrowing of the arches. Figures 1 and 2 show a Class II, Division 1 malocclusion in a mixed dentition. The patient had sucked his thumb from infancy. He was 8½ years old when the impressions for the casts were made. The back of the thumb was forced against the lower incisors in the sucking act; which may account for the distal rela-

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Read before the Section on Children's Dentistry at the Seventy-Sixth Annual Midwinter Meeting of the Chicago Dental Society, February 15, 1940.

tionship of the lower to the upper arch. Figures 3 and 4 show another Class II, Division 1 malocclusion of a mixed dentition in which thumb-sucking was an important etiologic factor. Figures 5 and 6 show a crossbite of the left side associated with a protrusion of the upper anterior teeth. The latter was caused by thumb-sucking, the cross-bite by a pillowing habit. The child slept with his right hand tucked firmly between the left side of the face and the pillow. The pressure was exerted mainly against the lower posterior teeth.

Lip habits are common, but figures showing the percentage of cases of malocclusion in which they are an etiologic factor are not available. I have noted several instances in which lip-biting or lip-sucking has followed thumb-sucking. A study of cases indicates that lip habits were just as effective in causing malocclusion as were thumb and finger habits. Figures 7 and 8 show models of a Class II, Division 1 malocclusion in which lip sucking was an important etiologic factor. Figures 9 and 10 show the separation of the upper anterior teeth associated with most cases of lip habit.

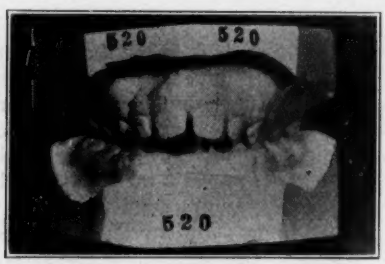

Fig. 1.—Protrusion of upper anterior teeth to which thumb-sucking contributed.

The tongue habits are difficult to detect in many cases, but they do contribute to many serious cases of malocclusion, particularly those involving an open-bite. Such a case is shown in Figure 11. As an infant, the patient sucked the first and second fingers of the right hand. The mother succeeded in breaking the habit, but the child discovered that he could place his tongue in the space created, and the space increased in size. The patient developed a combination tongue-thrust and tongue-biting habit that created a problem as difficult as the finger-sucking. Tongue-thrusting also may cause separation of the anterior teeth, particularly between the upper central incisor teeth. Figure 12, however, shows models of a case in which all the teeth were separated owing to an enlargement of the tongue, accompanied by a habit of pushing the tongue against the anterior teeth.

The pillowing habits may be responsible for malocclusion, particularly those cases involving a cross-bite, unilateral or bilateral. The variations of this habit will be described more fully later. Figures 13 and 14 show the models of the teeth of a boy 14 years of age, a case in which the malocclusion was largely caused by a leaning habit. The patient was left-handed and when writing placed his right elbow on the desk and rested his face against his hand. Figure 13 shows the lingual inclination of the upper right central and lateral incisor teeth. When the boy read, he placed his left elbow on the table or desk and supported his head by placing his left fist against his face. Figure 14 shows the definite lingual inclination of the posterior teeth on the left side of the arch.

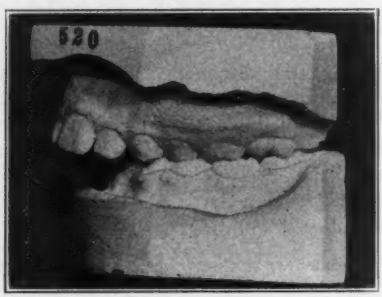

Fig. 2.—Lateral view of model shown in Figure 1.

Mouth-breathing may be an important

etiologic factor in malocclusion. A weakened and shortened upper lip is probably largely responsible for the protrusion of the upper anterior teeth seen in so many cases of mouth-breathing.

Undoubtedly, there is sufficient evidence of the importance of abnormal mouth habits in the development of the jaws of children. Johnson writes:

> The best thought in the profession agrees that there is definite evidence that thumb-sucking or finger-sucking may be an etiologic factor in malocclusion in either the deciduous or the permanent dentition. The habit may be accompanied by other habits called accessory habits, which may either modify or accentuate the malocclusion. These habits are mouth-breathing, open-mouth, lip-biting, lip-sucking, tongue-sucking, cheek-sucking, tongue-thrusting, etc.

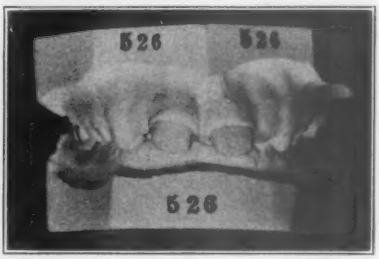

Fig. 3.—Protrusion and separation of upper central incisor teeth to which thumb-sucking contributed.

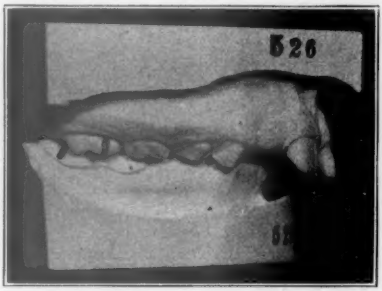

Fig. 4.—Lateral view of Figure 3.

Any dentist who wishes to take the trouble to observe them can find many instances of the influence of habits on jaw development. The illustrations that I have shown are some of the more common examples of malocclusion resulting from abnormal mouth habits. They could be duplicated many times.

Probably no other phenomenon of life plays a more important part in development than does habit. To discuss mouth habits, their effect on the jaws of children and their treatment, is impossible unless one first has some conception of what habit is. Whether a habit is good or bad may be largely a matter of personal opinion. If it is a social habit, its status is usually determined by majority rule. In the case of the several mouth habits, degree of rightness or wrongness is determined by the effects they may have on the growth of the jaws. And even there one finds a difference of opinion. On two occasions, it has been my privilege to hear a discussion of thumb-sucking in which a pediatrician and an orthodontist were among the participants. In these discussions, the pediatrician expressed the view that thumb-sucking did more good than harm. The orthodontist held the opposite point of view. Probably all of us need to get outside our own narrow realm occasionally and take a look at the total picture.

Habit is a phenomenon of life. It is both indispensable and relentless. Without it, man would remain the clumsy, groping person that he was as a child. Dressing, a social necessity, would consume hours. Eating, a physiologic requirement to life, would consume much more time that it does now. Walking would be a procedure requiring thought and attention with every step. However, because of habit, we are able to perform these daily tasks while our conscious attention is directed to the solution of other problems. It is strictly a phenomenal thing. To change any of those habitual acts would require conscious attention. Ordinarily, to make the change habitual would require many similar conscious efforts.

To this extent, habit can be relentless.

But if one wishes to change a habit, it can be done. The trouble in most instances is that actually the individual does not wish to change. That is what sometimes happens to one who attempts to stop smoking or drinking. The decision to stop is made because the physician advises it or because the patient himself thinks he should because of his health, business, etc. For several months, the patient succeeds in refraining from tobacco; then he returns to his old ways, simply because he never actually wanted to stop. Another mistake may be made by thinking about *not* drinking and *not* smoking, thus initiating the acts which lead to drinking and smoking. To succeed in habitually refraining from the habit, some positive interest or line of action must be found which will inhibit the drinking or smoking series and, by instituting another course of action, will bring about the desired result. In other words, some course of action must be found which has nothing to do with drinking or smoking, and will take the patient where he wishes to go. The discovery of this course of action is at once the means and the end. It is an established psychologic fact that until one takes intermediate acts seriously enough to treat them as ends, time is wasted in any effort to change a habit. Of the series of intermediate acts, the most important one is the next one.

What cannot be understood cannot be managed intelligently. If we are to treat abnormal mouth habits successfully, we must understand them. How often we treat only symptoms! How often we expect to "cure" thumb-sucking by any one of several known devices! Such treatment cannot in itself be successful, unless, first, the basic causes have disappeared and thumb-sucking remains simply as a habit; or, second, the basic causes are discovered and eliminated during the time that the appliance is in operation.

An intelligent understanding of habit formation would enable parents to so direct the activities of their children that many of the damaging mouth habits indulged in today would never be formed. Even such knowledge, of course, would not preclude their formation in certain cases, because of the complex pattern involved in habit building. It is doubtful whether we are ever able to recognize all the factors in any given case.

How may we apply such a theory of habit building to the many patients that we treat in our practices? The theory discussed briefly above would require more than the placing of an appliance in the patient's mouth or on his arm or thumb. It would require striking at the roots of the trouble, not alone at the visible manifestations of it. One of the simplest examples of this can be observed in cases of nail-biting. It is me-

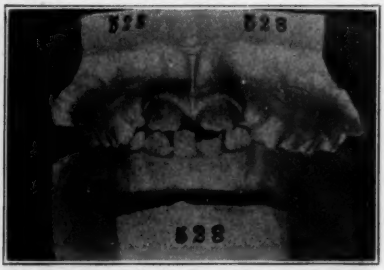

Fig. 5.—Protrusion and separation of upper central incisor teeth to which thumb-sucking contributed.

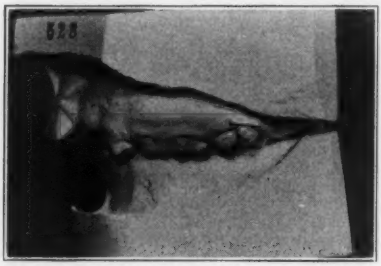

Fig. 6.—Lateral view of Figure 5; crossbite to which pillowing habit contributed.

chanically possible, of course, to prevent a child from biting his nails, by simply placing a labial arch on the lower teeth in such a way that the nails cannot be brought onto the incisal edges of the teeth. However, the underlying disturbance responsible for the nail-biting would remain, and eventually would manifest itself in another manner. I have seen a few cases in which patients were helped in their efforts to stop nail-biting by staying away from over-exciting movies and radio programs. Whenever they returned to such entertainment, the nail-biting was resumed. In some of these cases, the experiment was repeated several times, each time with the same result. Where the cause is as easily reached as that, no appliance is necessary. If the basic disturbance can be reached only with difficulty and after a long time, it is advisable to take steps to stop the actual practice of the habit, in order to prevent further disruption of the dental arches.

Fig. 7.—Protrusion and separation of upper anterior teeth.

Fig. 8.—Lateral view of Figure 7; showing Class II relationship of posterior teeth.

In thumb-sucking, the full cooperation of the child's parents is necessary for a satisfactory result. On the basis of a satisfactory theory of habit formation, it is not enough to merely treat the symptom, the act of placing the thumb in the mouth. Again, we must look for causes, and that is difficult. Thumb-sucking may be only a response to an exaggerated natural desire for sucking. The infant associates sucking with the most pleasurable sensations that he experiences, feeding from the mother's breast and from the bottle. Where no effort is made to increase the opportunity for a variety of experiences, the infant must become more and more dependent on the few it had in early infancy. Experience makes for growth. Actually, the child who sucks its thumb has failed to grow at the rate it should. The infant in a normal, natural effort to increase its experiences does so in the direction its previous ones have taken, unless its parents have provided intelligently for experiences at a higher level. Lacking such direction, the infant may suck its thumb. A few mothers have reported to me that they combated thumb-sucking and finger-sucking successfully by placing a rattle or toy in the child's hand. The complexity of the whole problem accentuates the need for prevention of habits by education of parents in child development.

In many cases, parents say that their child sucks his thumb only when falling asleep. One might find that the child as an infant was given a bottle as an aid in falling asleep. Eventually, the bottle was discontinued in the feeding procedure, but the presence of the nipple between the child's lips was a necessary act in the series of acts that induced sleep. The child, in seeking a satisfactory substitute, discovered his thumb,

and the series is again intact and sleep occurs. I believe with pediatricians that, in many such instances, little or no harm results from this habit. However, if the placing of the thumb in the mouth can be eliminated without violent disturbance of the infant and serious interference with its sleep, it should, I believe, be done. If the child sucks his thumb or fingers while falling asleep as a means of comforting himself, what we may need is a return to singing the child to sleep. There are, as you know, night clothes made which will prevent the child from putting the thumb in the mouth, but such prevention does not attack the problem at its base. The need that the child is supplying by placing the thumb in the mouth is not met, and it should be.

Fig. 9.—Protrusion and separation of upper anterior teeth to which lip habit contributed.

I recall the case of a boy 4 years of age who insisted that he be given a bottle when he went to bed. Finally, his father, in desperation and in fear that his boy might become a "molly coddle" as he put it, refused flatly to supply the bottle and forbade the mother to do so. It did not take the boy long to discover his thumb. The child was nearly 7 before the habit was finally broken. The treatment, I am afraid, proved worse than the habit. Child and parents alike developed "nerves" from the experience.

J. Howard Furby says:

Sucking habits include sucking the thumb, tongue, finger, or foreign bodies, such as *pacifiers* and bed clothing. As we find these habits prevalent among small children it seems to me, after studying the clinical nature of the act, that all of them are relics from the days of infancy when the child was entirely dependent on sucking for nourishment.

David M. Levy says: "Previous observations and clinical studies have demonstrated that the primary cause of finger-sucking is insufficient sucking at the breast." He related several experiments with infants and animals in proof. Continuing, he says:

There was not one instance of finger-sucking in the case of children who used pacifiers. . . . In general, psychiatric advice as to the finger-sucking has been to ignore it. . . . Besides the harm of excessive sucking, there is the danger of the malformation of the jaws.

Fig. 10.—Protrusion and separation of upper anterior teeth.

He recognizes too the possible danger to palate formation from excessive sucking.

From Levy's discussion, one might easily get the impression that thumb-sucking and finger-sucking were approached by the psychiatrist with a prayer and a hope. It is my opinion that the psychiatrist can be of real help to the dentist in the treatment of mouth habits in children, but first he must inform himself as to the dental problems involved. The dentist is not anxious to interfere with the normal nervous development of the child, but he cannot be quiet while the child is indulging in a

habit which is definitely detrimental to the development of his face and jaws. It is even more difficult for him to remain silent when he hears psychiatrists and pediatricians admit that those habits are manifestations of nervous disturbances and in the next breath condone them.

Johnson says that thumb-sucking is of two types: one causing protrusion of the maxillary incisors only, the other retrusion of the mandible in its relation to the maxillae. He continues:

> In the first type, the thumb is held so that pressure is exerted on the maxillary incisors in an upward and outward direction and the malocclusion produced is a neutroclusion. In the second type, the hand is allowed to drop in such a position as to exert a prying force on the teeth. Not only are the maxillary incisors carried forward by the thumb, but the alveolar process and the bone as well are molded into such form as to require special procedure in treatment of the malocclusion.

Fig. 11.—Open bite to which finger-sucking and then tongue-biting and tongue-thrusting contributed.

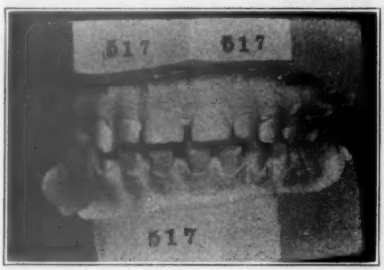

Fig. 12.—Separation of all anterior teeth caused by enlargement of the tongue and augmented by a tongue habit.

It should be noted that a heavy callous, sometimes a quarter of an inch thick, will be evident on the back of the thumb in this second type.

Many suggestions have been made regarding the treatment of thumb-sucking, some of them obviously of little worth, while a few have seemed to serve their purpose successfully in certain cases. Johnson suggests boxing gloves for the older child who sucks the thumb at bed time. The arms and hands are left free, but the large leather thumb cannot be placed in the mouth. Johnson and Furby believe that the child should be made acquainted with what is being attempted. He should be told, however, that by no means should the treatment be considered punishment, but should be regarded as an effort to help him solve his own problem. I believe one should interpret this as applying only to the child who is of an age to understand something of the problem. The younger child is probably best served by telling him nothing. By telling him what is being attempted, one simply calls his attention to the habit and to himself, and the parents may find later that the child uses the thumb-sucking simply to attract attention to himself. Harold Chapman and M. P. Michaelis, English dentists, point out the soundness of such advice in treating young children.

A case that I treated a short time ago will clarify this point. The girl had been a thumb-sucker as long as her nurse could remember, which meant since infancy. In spite of my warnings, the mother and the nurse persisted in attempting to stop the child by threatening her with something dreadful at my hands. The child had absolutely no idea what that might mean and, each time she came in the office, she would point to various things and ask if that was the thing I was going to use to keep

her from sucking her thumb. The girl did not stop the habit; in fact, she indulged in it to a greater extent than ever. The mother and the nurse had succeeded only in focussing a great deal of attention on the child. Finally, when she was 4½ years of age, I was permitted to place an appliance on the teeth to stop the habit. The mother agreed not to tell the child what it was for. The patient is now 7 years old. She does not suck her thumb and she was never aware that she had been treated for thumb-sucking. The habit has been forgotten in the family, and the child undoubtedly gets attention in other ways, but at least she is not aggravating the malocclusion.

The appliance used consisted of

Fig. 13.—Lingual inclination of upper right central and lateral incisor teeth resulting from leaning habit.

crowns fitted to the upper first deciduous molars and supporting a bar of approximately 11 gage directed across the palate and well away from the tissues. This was cemented to place. With such an appliance in position, it is impossible for the child to create suction. The pleasure is removed and the effort stops (Fig. 15). Such an appliance has been suggested by many, and its authorship is indeterminable.

Of the many kinds of treatment suggested for thumb-sucking, the use of bitter-tasting medicine, thumb-guards or elbow cuffs has probably been suggested most frequently. Medicines deter the young child for only a short time and are therefore of little benefit. Such devices as thumb-guards and elbow cuffs interfere with the normal use of hands and arms, and their use should therefore be discouraged.

The most important aspect of any treatment is the approach made, first by the parents and then by the dentist. If the dentist fails to gain the cooperation of the parents, he can do little. On the other hand, parents can remedy the condition without the aid of a dentist. We must never lose sight of the fact that when we are dealing with children, we are dealing with individuals; and as individuals, they present different problems. In speaking of habits, we are

Fig. 14.—Occlusal views of case shown in Figure 13; showing lingual inclination of posterior teeth of left side, particularly in lower arch.

liable to think and treat in terms of thumb-sucking, or of lip-biting or of any one of the many other kinds of habit, instead of in terms of the individual child. We should never lose sight of the fact that we are not treating the habit; we are, rather, treating the child with a habit. If we can think in those terms, we shall have a better chance of succeeding in our treatment.

Parents who nag a child or scold him severely, hoping by the use of such tactics to help the child stop the habit, succeed only in calling his attention to it. Re-education of the child will repay parents and child many times the effort made. It is a difficult thing to under-

stand why so many people fail to change their approach when they see that scolding has no effect. Occasionally, one hears of cases that have been helped by frightening the child, but generally speaking, this approach should be discouraged.

Johnson describes a method which requires the child to sit before a mirror and suck its thumb. He says:

> This method is based on the theory that when the habit becomes a conscious act, it is automatically broken. In its application, the child should be taken from his favorite play, placed in front of the mirror and told to suck the thumb as he watches the performance in the mirror. This should be done in the presence of the mother and the whole procedure should be undertaken in a serious mood. The length of each practice period should be governed by the age.

I cannot believe that this would work with a young child. In older children, say over 7 years, I believe that the danger of ridicule is too great. One must constantly think of the child's personality in doing this kind of thing.

In handling the older child, a confidential and sympathetic talk combined with the use of a mouth appliance will, I believe, do the most good. The child will not resent the use of an appliance, because it does not show. Further, he should understand that it is placed in his mouth to help him, not to punish him. Nothing will disturb a child more than to make him feel he is being punished for something over which he has no control. What he needs is help and sympathy, not given in a maudlin fashion, but in a businesslike way; for it is equally important for the child to understand that the habit cannot be used as a means of gaining more than his share of attention.

As I write, I realize more and more the delicate balance in which all this procedure of habit correction hangs. The great need for constant consideration of the individuality of the patient and the many factors which make up that individuality becomes ever more apparent.

Fig. 15.—Appliance frequently used to help in correction of thumb-sucking. The extension toward the right incisor teeth was used to make the placing of the thumb more difficult.

Fig. 16.—Vulcanite button which fits and is held against palate with tip of tongue. It is used to teach the new tongue position.

Factors must be weighed one against the other, individuality against individuality and parent against child in our effort to combat habits. Is it any wonder that we fail so often, and that, in some of the cases in which we succeed in stopping thumb-sucking, we see other habits equally distinctive take their place?

Levy describes nail-biting, lip-sucking and biting and other finger manipulations as modifications of thumb-sucking. Quite often, one observes lip-biting following thumb-sucking. The child may have met the wishes of parents by stopping the thumb-sucking, but continued to get satisfaction by biting or sucking

the lower lip. Or the malocclusion caused by the thumb-sucking may have made it difficult to hold the lips together and the lower lip has been drawn lingually from the upper teeth. Furby suggests that the biting habits, in which he includes biting the lip, tongue, cheek, fingernails and foreign bodies, such as pencils and pen holders, are caused by restrained expression. He says that fright may also be a factor. He explains that the natural expression of the child is fought by parents, teachers and others who may come in close relationship with the child. The restriction of his expression is manifested by one of the habits mentioned above. It is realized by those who have the opportunity of observing the mouths of many children that lip,

Fig. 17.—Attachment band cemented to upper central incisor tooth. The lingual surface is roughened in order to cause discomfort to the tongue when pressed against it.

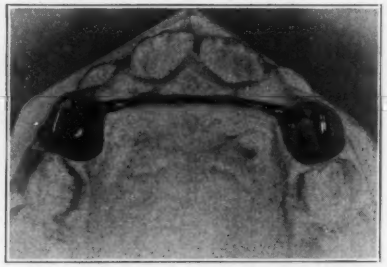

Fig. 18.—Appliance used because patient took almost entire lower lip between his teeth. The appliance shown in Figure 17 was inadequate.

tongue and cheek habits can be as powerful an influence in causing malocclusion as is thumb-sucking. The latter has received a great deal of publicity and also is easily observed by mothers. As a result, the parents are usually more concerned about it than they are about the other habits.

Tisdale says that tongue habits may develop as a result of loss of an anterior deciduous tooth. He writes:

> It commences with the curious thrusting of the tongue into a space created by the loss of one or more deciduous teeth, usually the maxillary central incisors, and, as often is the case, augmented by the loss of corresponding teeth in the opposing arch. The loss of these teeth in such cases occurs some time previous to the eruption of their replacing permanent teeth and by the time their eruption takes place the tongue thrusting has become a habit, a reflex action entirely disassociated with conscious control.

In discussing treatment, Tisdale says that the patient should be taught a new tongue position. Rhobotham taught the use of a vulcanite button to patients with tongue habits. The vulcanite button, which was made to fit the palate, had two holes cut in it so that it might be fastened to the child's garment by a long thread, to prevent swallowing. The patient held the button against the palate with the tip of the tongue for periods of from ten to fifteen minutes, three or four times each day. Others have suggested the use of life-saver candies, held in the same way, on the theory that the inducement to the child is greater.

A simple device which can be used in principle in most cases of lip-biting, lip-sucking, tongue-thrusting, tongue-biting, cheek-biting and cheek-sucking consists of an attachment band, roughened on the lingual surface, and cemented to a central incisor tooth. (Fig. 17.) No explanation need accompany the placing of the band. In fact, in most instances, it is sufficient that the child know only

that it is a necessary procedure in the treatment of his teeth. Of course, he will be conscious of the presence of the band, because it will interfere with the habit. However, cessation of the habit can take place without awareness on the part of the child. In extreme cases, an appliance as shown in Figure 18 is used. The short spurs on the lingual wire should not be sharp enough to cut the lip. The appliance is not placed to punish the child, but to help him. A child's nurse once stopped him from biting his lip by teaching him to whistle. The child was 4 years old. An appliance similar to the one shown in Figure 18 was used and the wire gradually lowered until it interfered with the occlusion. The patient persisted in biting part of the lip. The child's nurse was asked to teach him to whistle. The new lip position stopped the habit.

As indicated earlier, the group of habits known as the pillowing habits has many variations, all of which it is difficult to detect because the dentist has little or no opportunity to observe them. He must depend on the parents and on the child to tell him about them. Some children place the hand between the face and the pillow when sleeping. Others rest the head on one hand while writing or reading. Still another variation is seen when the child lies full length on the floor, reading the newspaper, propping himself up on both elbows and resting his head on both hands. This group of habits it is relatively easy to change. Removal of the pillow for several nights is helpful. If a teacher or parent calls the child's attention a few times to the fact that he is resting his head in his hands, it is not long until the habit is corrected. We can assume this if the child is willing to cooperate, and if the possibility that some physical condition is responsible for the apparent laziness has been rejected.

Correction of mouth-breathing often proves difficult. The condition may result from a malocclusion in which the upper anterior teeth protrude so far that the lips cannot be brought together normally. However, comparatively few cases of mouth-breathing develop in that way. Usually, the condition is associated with enlarged tonsils and adenoids. It is common practice for surgeons to postpone operations on tonsils and adenoids until the child reaches the age of 5 or 6. The surgeon, of course, knows when he should operate. If the child becomes a mouth-breather at as early as 1½ or 2 years, and the condition is not corrected until the age of 5 years, the practice becomes a habit. Removal of the enlarged structures is not sufficient to correct it. New sets of muscles have assumed the function of aiding in respiration. The nasal muscles are underdeveloped and incapable of resuming their normal function, unless helped.

To correct mouth-breathing after a tonsil and adenoid operation is an intricate problem, requiring the cooperation of child, parents, physician and dentist. One of the best modes of treatment is as follows: 1. If the mouth-breathing is associated with protrusion of the upper anterior teeth, the latter is corrected. 2. Exercises to restore normal function of the orbicularis oris and mentalis muscles are given. 3. The child is asked to run or perform some other exercise which increases his breathing rate and meanwhile to keep his lips together. Such exercises will prove exceedingly beneficial if performed several times each day. The lips can be kept together only for a few seconds the first times the exercise is taken. As the muscles develop, however, closure of the lips can be maintained for a matter of minutes at a time. Johnson indicates that attention must also be paid to the tongue in many cases of mouth-breathing. He says:

> One of the worst features of the open-mouth and mouth-breathing habits is the loss of normal function of the tongue in the formation of the arches and palate. Correct

function of the tongue in swallowing and its position at rest after swallowing are of primary importance in the treatment of those habits.

There can be little question about the importance of mouth habits in the care of children. Obviously, too, success eventually must be thought of in terms of prevention. The intricate patterns which habits can assume indicate that successful treatment is possible only in some cases. Many others will simply be diverted from one habit to another. In still other cases, failure to find the cause will prevent any chance of changing the habit at all. In referring to seeing the child for the first time, Johnson asks:

> But what of habits and maladjustments which are already established? Dentistry will not assume its full responsibilities nor take advantage of its opportunities for prevention until the child is under observation from birth.

Knowledge in the field of child development indicates that growth can be controlled in infants by the experiences that he has. Parents can direct habit formation in their children by the kinds of experience they give them an opportunity to enjoy; all of which would require parent education in the field of child development—certainly not an easy task. Still, prevention is worth any effort we put forth in its favor. When dentists generally acquaint themselves with the information available in the field of child development, so that they in turn will be in a position to help parents with their problem of directing habit formations in their children, a tremendous advance will have been made.

CONCLUSIONS

1. There is evidence that abnormal mouth habits may affect the occlusion of the child.

2. As is true in all habit formation, many factors are involved in abnormal mouth habits.

3. A sympathetic approach to the child's problem is better than nagging or scolding.

4. Prevention should be the goal. This can best be achieved by providing numerous and varying experiences for the child.

5. Parents must acquire more knowledge in the field of child growth and development, if prevention is to become general. Dentists can help by pointing out this need and by directing parents in their choice of reading in this field.

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THE FULL DENTURE FROM THE PATIENT'S POINT OF VIEW

By DeForest Davis,* D.D.S., Cleveland, Ohio

DURING twenty-one years of research in the field of full denture prosthesis, the National Society of Full Denture Prosthetists has, to a large extent, solved the basic problems involved in its work. As a result, the dentist, when he applies the knowledge, materials and equipment which are now available, is able to restore the functions of the human dentition in a highly satisfactory manner. In fact, the modern full denture, even with some faults still to be overcome, is recognized as more completely restoring the functions involved than any prosthesis that is applied to the human body. One cannot see with an artificial eye, though it may not appear artificial; one can only limp with an artificial leg, and the unpleasant appearance of the most expensive toupee is all too obvious.

The person who has gone through the tragic experience of losing all of the natural teeth, however, has the assurance that, with a modern set of dentures, he can, under reasonable conditions, learn to chew his food with efficiency and comfort, to enunciate clearly and to smile and laugh freely with full confidence that, even on close observation, his artificial teeth will seem to harmonize with his whole countenance and appear like his own. This is an accomplishment which the whole dental profession can well be proud of; but this particular organization should have special credit for providing the inspiration and incentive for the prolonged study which has resulted in the present solution of this difficult problem; not to mention the zealous and efficient continuity of its efforts.

In view of the superior understanding acquired by the members of this group, I, as a general practitioner, would not presume to present theories relating to this phase of dentistry.

The objective in this paper, therefore, shall be to emphasize a point which seems to be small, but is nevertheless important and is, I believe, too frequently overlooked or inadequately considered by both practitioner and teacher. I refer to the matter of obtaining the patient's good will and cooperation, the lack of which can become a serious handicap.

In my title, I referred to the patient's point of view because I believe that the more nearly we can assume and adhere to this position, the more readily and effectively will the patient respond. Taking the other man's point of view is essential to success in all human relationships, but particularly essential here, because of the unique kind of cooperation required of the full denture patient.

A successful business executive has said: "Find out what your customers want and give them more and more of it." He thinks it is wise to put himself exactly in the customer's position; to think his thoughts about merchandise, buying and service, and understandingly provide the things he wants.

Lord Lister, the English surgeon, admonished the medical profession in these

Read before the National Society of Full Denture Prosthetists, Milwaukee, Wis., July 13, 1939.

*Deceased.

words: "There is only one rule for the physician: 'Place yourself in the patient's position.'" What *is* the patient's position and what does he want more than anything else? He wants to get well, and, during the process, he wants to be thoroughly convinced that those in charge of his case are applying the utmost in modern skill and equipment, along with a generous quantity of sympathetic understanding expressed in terms that he can understand.

When a man loses the last of his teeth, there is precipitated for him a new and serious problem. Even though he has procrastinated and anticipated the ordeal for a long time, there is no way whereby he can prepare himself to meet the great shock to his ego that invariably comes as the last tooth disappears.

At the moment, he is deeply concerned about himself and the fact that he must face the future without his own teeth. He wants a dentist upon whom he can rely with full confidence to give him skilful service and who, at the first consultation, will be able to make him mentally comfortable in the knowledge that now his problem will be satisfactorily met.

He wants to like this dentist, and if he cannot like him, he will probably not patronize him, regardless of his reputation or skill.

So it would seem that besides knowing all about the technical aspects of our work, it is important that we know how to get along with our patients.

To accomplish this, among all the numerous things that can be done, the most important, at the outset, is, I believe, to determine what is in the patient's mind regarding his dental problem. Much that he tells us will be irrelevant; but we must be tolerant and listen with interest, for, at this point, the dentist is molding the patient's attitude toward the whole problem at hand and particularly toward the dentist himself. Let the patient present his ideas and experiences. Let him ask all the questions in his mind regarding how long it will take to make the dentures, how much it will cost, how he will look and feel, how long they will last, etc. He should be made to understand that the information which he is providing is important and will be helpful. This will satisfy his ego, will make him pleased with himself, to think that he is able to be of real assistance to his dentist. He is now in a mood to give enthusiastic cooperation. He has a friendly feeling toward the dentist which can be maintained by the same process that was used in establishing it.

After this conversation (it may take several), if the dentist has asked the proper questions and made correct observations, he will be able to quite accurately classify the patient, as to temperament, intelligence and economic status. This information, combined with his good will, provides an excellent foundation for planning the work that is to follow. We can now place ourselves in the patient's position, view the entire problem from his point of view and persuade him to do what we believe is best for him in his particular circumstances.

While I am convinced of the value of deliberately gaining the patient's confidence and good will at the outset, and I believe that patients of all types will respond equally to an appeal to their ego when properly approached, I am fully aware that there are other facts which, when overlooked, can prevent the establishment of the desired attitude. These things are elementary, but even the most advanced among us are at times, I believe, prone to overlook them in some degree. I refer to the patient's temperament, the dentist's personality and the personality of his office. Let us consider them in their order.

M. M. House, in discussing temperament, has classified patients into four groups: the philosophic, the exacting, the hysterical and the indifferent. The psychologist offers a different classification, saying that temperamentally people fall

into three groups: the extrovert, the introvert and the ambivert, the last being a mixture of the first two and the group to which the great majority of people belong. It is the method of science to classify and I presume it may be wise for us to be able to place the different types as they appear. But to make this practical, we must know the particular kind of treatment that is required by each.

This brings us back to our previous idea that the patient's ego is the most effective avenue of approach in seeking the valuable element of good will. We are all egoists, regardless of temperament. The extrovert, the introvert, the ambivert, the exacting, the hysterical, and even the philosophic and the indifferent, all enjoy having their ego inflated and they will like the person who does it. For example, the extrovert loves his dog just as much as the introvert loves his, and when either is told that his dog is superior, he will be pleased and experience a kindly feeling toward the one who expressed the opinion. The hysterical lady patient will be just as pleased as the ambivert when told that her young daughter is a beautiful girl and an excellent patient.

Undoubtedly, the classification of temperaments and an understanding of each are of value in dealing with people, but it would seem quite unwise to ignore the fact that we all like the man who, by any means, enlarges our self-esteem.

Personality is the total of the impression we make upon people. It is important to every one, but particularly to the dentist because his professional success is wholly dependent on reactions to his personality.

There are many elements, large and small, which go into the making of a personality. There is little need, however, to enumerate them for this audience because all people possess the personal qualities required to impress others favorably.

The psychologists say that we all have in some degree an inferiority complex, and this is our most common handicap in developing a favorable personality. This may be the result of any one of numerous causes, many of them quite insignificant.

Robert K. Brown[1] has this to say on this point:

> There are two basic causes for this [the inferiority complex]: The first is personal. It may be of a physical nature, from lack of height, obesity or various other physical handicaps. It may result from mental inferiority, a feeling that one is not on the same intellectual plane as many of one's associates. It may be of a moral or social type. The second cause is based on a vivid past experience, perhaps ridicule from parents or classmates over some escapade or on an occasion when singing, reciting or some athletic pursuit was indulged in. . . .
>
> The person who suffers markedly from an inferiority complex is prone to boast and to shirk any task that he fears, and he will try to rationalize his present position by using reasons for not attempting these tasks. Try to get some one to speak whose past experiences along this line have been disastrous. He can give very convincing reasons why he cannot attempt to grant your request. . . .
>
> The feeling of inferiority must be removed by using a compensating procedure of conduct that will afford a feeling of superiority. Many rely on religion or on getting more and more knowledge along a certain line of thought so that they really become specialized. . . . If an inferiority complex is overcome, further improvement of one's personality becomes possible: we will be able to get along with others better, for we will like them and they, in turn, like us. We have lost our feeling of embarrassment and are developing self-confidence.

In America, the personality of the office has received much attention, indicating that it is considered an important adjunct in promoting confidence and good will in the mind of customer or client. There are firms who specialize in office design, decoration and furnishing, for the single purpose of creating an atmosphere which will have the proper psychologic effect on the particular type

of clientele to be served. The importance of this for the dentist is obvious. His office should give the impression of scrupulous cleanliness. It should be efficiently arranged to meet the needs of both patient and dentist. It should not be elaborate, but should have an air of quiet refinement. When the patient enters, he should receive the impression from all that he sees that here is a busy, an efficiently managed establishment, where he can get the kind of service that he wants.

In conclusion, I should like to emphasize again the value of placing ourselves in the patient's position as a starting point from which to proceed with the treatment. I say to myself, "Were I this patient and occupied his exact position, intellectually, temperamentally, economically and socially, what would I like to have done for me?" The answer is the best guide that I know of to attaining a satisfactory result.

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PLATINUM-IRIDIUM CASTING: A NEW CONCEPT OF THE DENTAL CASTING PROCESS

By ERNEST R. GRANGER, D.D.S., Mt. Vernon, N. Y.

INTRODUCTION

THE development of a successful technic for the casting of platinum-iridium and similar alloys of the platinum group has brought about a much clearer understanding of the functioning of the materials and equipment used in the dental casting process. Past attempts at casting platinum by the usual methods, simply substituting it for gold, have brought uncertain results. Yet, in general, the metals do not differ greatly. The reason for the uncertain results is that the physical properties of the platinum group are such that they magnify every defect in technic. Knowledge of these facts decreases our difficulties and points the way to improved results in all methods. It is no more difficult to cast platinum than gold: it simply requires a perfect technic; not in the sense of unusual manual dexterity, but rather in the knowledge of what to do. Although the technic described here is applied particularly to casting platinum, the principles involved apply with equal force to all metals.

Read before the American Academy of Restorative Dentistry, Milwaukee, Wis., July 15, 1939.

CASTING SHRINKAGE

Figure 1 shows a cross-section of an ingot mold frequently employed in the manufacture of precious metals. If we were to cast a simple bar of any metal into this mold at a sufficiently high temperature and allow it to cool slowly, the resultant casting would shrink in all dimensions. No exact figures are available for platinum, but as nearly as I have been able to determine from close observation, it is approximately 11 per cent. For practical purposes, we may divide this total casting shrinkage into two parts: (1) the freezing or crystalliz-

ing shrinkage which takes place when the metal goes from the fluid to the solid state, and (2) the coefficient of expansion (or contraction) which takes place between the freezing point and room temperature. For the moment, I shall ignore the coefficient of expansion and consider the freezing shrinkage.

FREEZING SHRINKAGE

If, as in Figure 2, we cast into a cold mold, freezing shrinkage takes place within the casting. The casting theoretically shrinks an amount equal to its coefficient of expansion. In this case, the

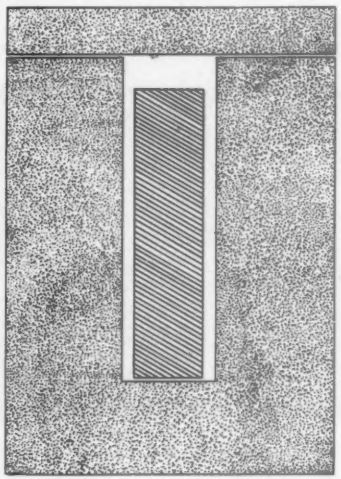


Fig. 1.—Freezing shrinkage in hot mold.

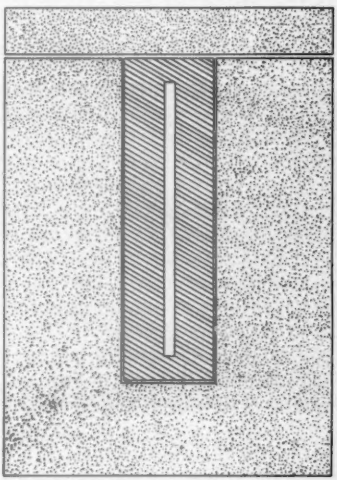


Fig. 2.—Internal freezing shrinkage in cold mold.

casting shrinkage is just the same as it was in Figure 1, but freezing shrinkage has taken place internally and has not affected the outside dimension of the casting.

Freezing shrinkage, in the sense in which it is employed here, may be considered as an "internal dimension," as well as the external physical size of the casting. The form that this freezing shrinkage takes will depend on the melting range of the metal. In the case of alloys composed wholly of the platinum group, the melting range is so extremely narrow as to be negligible. In such cases, when the casting freezes, it forms a "pipe" in the center of the bulkiest portion of the casting. With most casting golds, since they all possess a wide melting range, the shrinkage is distributed throughout the casting as a multitude of microscopic "pipes." It is possible to eliminate virtually all of this shrinkage within the casting by proper technic, and thus bring about a decided improvement in the physical properties of all castings.

The question naturally arises as to how cold a "cold mold" is. I have defined a cold mold as one chilled sufficiently for almost instantaneous freezing of the casting, but warm enough to permit the metal to fill the mold before it freezes and forms "cold shuts." Obviously, a mold so cold that rapid freezing of a relatively thick casting such as a large mesioclusodistal inlay results would have to be at a temperature so low that if we attempted to cast a very thin coping, or three-quarter crown, we would probably develop cold shuts in the latter. On the

other hand, a mold sufficiently warm for casting very thin sections without cold shuts would be so warm that sufficiently rapid freezing of a very heavy casting would not result.

There are a number of reasons why it is essential to cast into as cold a mold as possible, the most important of these being the physical properties of the metal. In Figures 3 and 4 are two photomicrographs of identical castings of platinum-iridium made into molds of different temperature. They were invested with the same mix and burned out in the same furnace at the same rate, but A was withdrawn and cast at 1200°, whereas B was cast at 2000°. As the freezing point of this particular alloy was about 3600°, from the standpoint of freezing shrinkage they are both relatively cold molds. In the hotter casting, the large coarse crystal structure and wide boundaries are evident. In Figure 4, A, the small fine crystal structure and the absence of shrinkage pipes are apparent. The colder mold produced an appreciably faster precipitation. Although these castings look identical to the naked eye, there is a vast difference in their physical properties. Therefore, it is essential that we cast into as cold a mold as possible. The question of how cold it is possible to have the mold and still obtain a casting is dependent on a number of conditions, which will be considered later.

If we cast a cone-shaped ingot, such as is shown in Figure 5, since the diameter increases from the apex toward the base, the portion of this casting which remains molten at any given moment is a constantly rising point. Therefore, freezing shrinkage will take place as an approximately circular void near the top of the casting.

Figure 6 shows a cross-section of a mesioclusodistal inlay or full crown, illustrating a conventional method of sprueing and investing. You will note a shallow, saucer-shaped sprue former, a relatively short small sprue, attached below the contact point of the pattern, with usually a small reservoir adjacent to the point of sprue attachment, and a relatively short distance between the top of the button of metal and the casting. We know from our previous diagrams that if the casting is made into a relatively cold mold, the point of sprue attachment will be one of the first places to freeze. Therefore, when crystallizing shrinkage takes place across the occlusal surface, there cannot be any new supply of molten metal to compensate for that shrinkage. Although this will be an accurately dimensioned casting, it will not be a sound

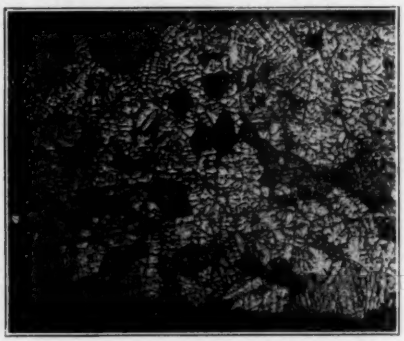


Fig. 3.—Crystal structure of cold mold casting.

Fig. 4.—Crystal structure of hot mold casting.

casting. It is easy to demonstrate the fact that this does occur, and it was a considerable source of trouble in our early work. It was a common experience to cast what looked like a very good inlay, only to have it break under even the slight pressure of cementation. This was partially due to other conditions, which will be considered later, but it was the means of discovering that this shrinkage will always occur if castings are sprued as for gold.

In Figure 7 is shown a somewhat exaggerated diagram of the method which has been found very successful for platinum, and which it has been possible to apply to the improvement of castings in all metals. There is a very steep-tapered sprue former with relatively large sprues, in most cases an inch in length, attached to the surface adjacent to the greatest bulk of the casting.

If the diameter of the sprue is greater than the thickness of the part to which it is attached, the casting must freeze before the sprue, and freezing shrinkage will take place as a pipe within the sprue. One sprue has been attached to that part of the casting which is to freeze first. The reason is that, as pointed out earlier, there is a great freezing shrinkage. If we attempted to compensate for all of the freezing shrinkage that will take place in the interior of the casting, from the sprues attached to the "freezing centers," we would have to use disproportionately large sprues. By attaching one large sprue to that portion of the casting which will freeze most rapidly, since shrinkage of that area takes place before any shrinkage has taken place at the point of attachment of the other sprues, its tendency to freezing shrinkage will be withdrawn from the center sprue, less being left to be made up by the remaining sprues. A small area of the button is exposed to the cooling effect of the air, and there is a relatively long distance from the top of the button to the casting. This is necessary because freezing shrinkage is taking place from the button down as well as from the casting up. If the button of metal is sufficiently large to remain molten a longer time than the casting, this

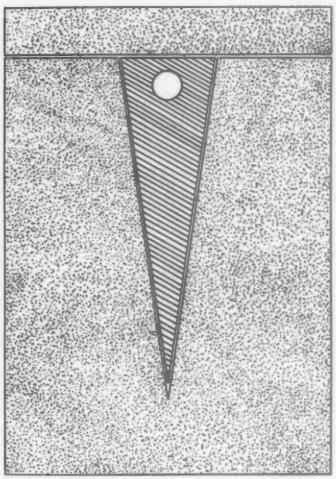


Fig. 5.—Freezing shrinkage of cone-shaped cold mold casting.

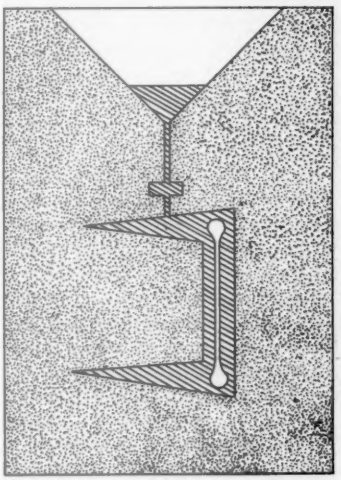


Fig. 6.—Diagram showing how improper sprueing results in weak, porous castings.

will not be of any consequence; but if that should not be the case, the pipe formed in the button might draw enough metal from the sprues so that there would not be a sufficient amount left to make up for the deficiency within the casting. The actual size, shape and position of the sprues would, of course, be dependent on the individual casting, but in general must follow this plan.

In our previous diagrams, we have shown how crystallizing shrinkage is eliminated from the casting, but we have yet to compensate for the coefficient of expansion. This is the famous 1.25 per cent

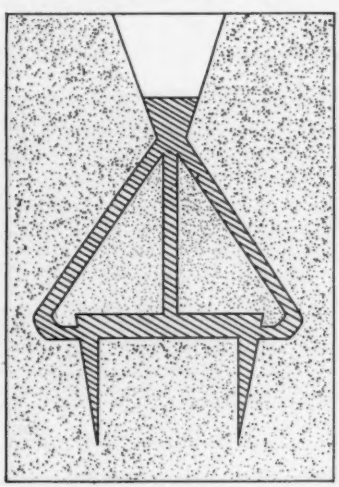


Fig. 7.—Proper method of sprueing feeding shrinkage centers to produce sound malleable castings.

shrinkage which is generally referred to in gold casting, but which you will see later is an extremely variable factor in actual practice.

COEFFICIENT OF EXPANSION

It is a well known fact that, in practical work, net casting shrinkage is always less than would be expected in consideration of the actual coefficient of expansion of the metal. The Bureau of Standards demonstrated many years ago that, under certain conditions, a soft inlay gold with a total coefficient of expansion of 1.85 per cent may have a net casting shrinkage as low as 1.25 per cent. Practical observation has also shown that different types of castings undergo dimensional changes which may require differences in expansion, but no adequate explanation has been offered for the phenomena observed by careful measurement. Various attempts have been made to explain it on the basis of wax shrinkage, warpage and crystallization. While, as we shall see, these do enter into the picture, they are by no means the principal factors.

Figure 8 is a graph showing a straight line expansion of a typical casting gold, a curved line expansion of an investment containing 30 per cent plaster and 70 per cent silica and a dotted line shrinkage curve of the investment material. Actually, it is the shrinkage curve which is of greatest importance to us, since it is the principal cause of differences in dimensional accuracy. This curve indicates a partial collapse of the mold as it cools, and it is of particular importance to note that, as long as the temperature continues to rise or is maintained at a level, this cannot take place; but as soon as the mold begins to cool from the highest temperature to which it has been raised, the collapse starts.

Ordinary dental investment material, when it comes to us from the manufacturer, must contain some water of crystallization, as otherwise it would not set. We add more water to produce plasticity, so that an average mold contains approximately 40 per cent by volume of water. The exact amount is not pertinent to the present discussion.

The mold, after it has set, is placed in a furnace to drive off the water. If we were to examine this mold under a low-power microscope before it had cooled, we would see something very much like the drawing in Figure 9. The place which was formerly occupied by the

water of crystallization and hygroscopic water is now left vacant between the grains of silica. Since the grains of silica expand as they are heated, as long as the temperature continues to rise or is maintained at a level the expanded crystals are wedged together in such a manner that they tend to maintain the form of the mold. As soon as the mold begins to cool, and the crystals begin to contract, the refractory particles collapse into the spaces left by the water of crystallization, and the mold undergoes marked shrinkage.

As I have stated previously, the net casting shrinkage is always less than is to be expected from the coefficient of expansion of the metal, because the metal

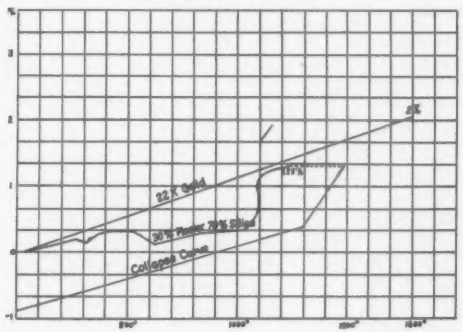


Fig. 8.—Comparative expansion and collapse curves for ordinary investments and casting gold.

when it freezes it still plastic. The mold, as long as it is heated or the higher temperature of the metal continues to raise the temperature of it, stretches the metal through that portion of its cooling range where it is frozen, but still plastic. When metal and mold reach the same temperature and both begin to cool, the mold undergoes a partial collapse, allowing the metal to shrink as it will.

Referring to Figure 8: If the mold is at a temperature of 1000° and the freezing point of the metal is 1700°, as the metal is cooling, the temperature of the mold is rising until they meet at some point which for the moment we may assume to be approximately 1350°. Therefore, the mold stretches that metal over 350 degrees of its cooling range, before it collapses and allows the metal to shrink freely. That is to say, the net casting shrinkage will be less than the total expansion of the metal by an amount equal to its coefficient over a 350° range. But suppose that the mold were at a temperature of 1300°: with the same investment, the same metal would be stretched only over 200 degrees of its cooling range before the collapse of the mold allowed it to shrink freely.

Therefore, by altering the temperature of the mold, we have changed the net casting shrinkage of the same metal. Little attention has been given the fact that the 1.25 per cent which is usually spoken of as the net casting shrinkage of gold was arrived at by casting a soft 22-carat inlay gold into molds much colder than are ever employed in actual practice. They varied from room temperature to 300° C. Therefore, they exerted the maximum possible amount of stretch upon the metal until it finally reached a point where it crushed the mold before collapse took place. Proof of that lies in the fact that when this experiment is duplicated with "hot short" metals, the mold will frequently break the test bars before it collapses. Further observation has shown that under practical working

conditions, the net casting shrinkage of various modern gold alloys may be varied from 0.9 per cent to 1.6 per cent with various types of castings under different casting conditions and investment materials. Therefore, to assume that an investment material, because it has an expansion of a certain percentage, will produce accurately dimensioned castings is simply a guess which has no foundation in fact.

Theoretically then, if we standardized our investment and mold temperature, we would obtain uniform results; but, as the metal is being stretched, other changes are taking place. An average plaster investment possesses a crushing strength when heated of about 400

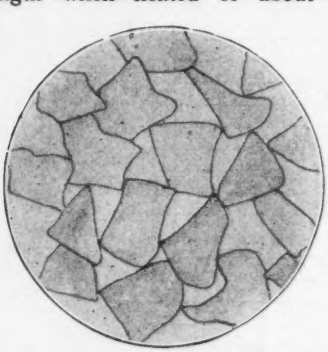


Fig. 9.—Microstructure of plaster bonded investment after heat has driven off water of crystallization and before cooling has allowed collapse.

pounds per square inch. The result is that when the casting cools, if we attempt to utilize to any large degree the stretching effect of the mold, the effect is somewhat as shown in Figure 10. As the casting loses its plasticity, the heavier occlusal portion connecting the two legs of a mesioclusodistal inlay will exert greater crushing effect upon a given investment material than the thinner proximal portions. In the same manner, the heavier portions of any casting will be less readily stretched than the thin sections, a warpage resulting. This effect is not readily observed in ordinary practical gold inlays inasmuch as the difference between mold temperature and the fusing point of the metal is usually only a matter of a few hundred degrees, and the cavity preparations are not made with sufficient accuracy. The lower the mold temperature employed, the less the net casting shrinkage; but the longer the stretching range, the greater the warpage. This unequal stretching effect does, however, become noticeable in large thin castings, such as one-piece castings of partial dentures, and can be readily demonstrated with precision attachments.

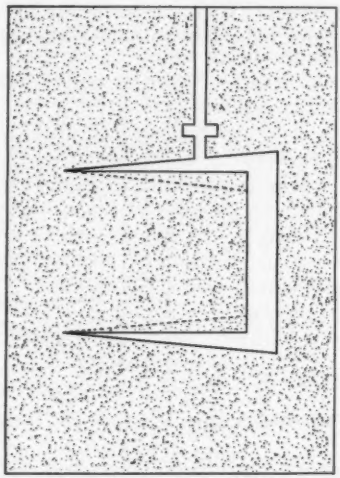


Fig. 10.—Diagram showing how moderate crushing strength causes warpage of castings upon cooling.

The logical solution would then be to use a higher mold temperature and less stretching; but the closer the temperature of the mold to the fusing point of the metal, the greater the net casting shrinkage and the poorer the physical properties. For that reason, physical properties given by manufacturers for various casting golds are usually arrived at by casting into molds at relatively low temperature.

Of even greater importance is another

phenomenon which enters into this problem, and that is the fact that if we attempt to cast a segment of a circle into a mold which allows free shrinkage of the metal, there always is a tendency for the arc to straighten or become flatter. As the mold temperature is raised and the stretching decreased, the free shrinkage increases. Practically all of our dental castings, with the exception of simple occlusal inlays, are somewhat distorted segments of circles. A three-quarter crown, a mesioclusodistal inlay, a mesioclusal inlay, a partial denture and a cast clasp are all irregular segments of circles. Therefore, whether caused by free shrinkage or unequal stretch, the condition shown in Figure 10 will always be present.

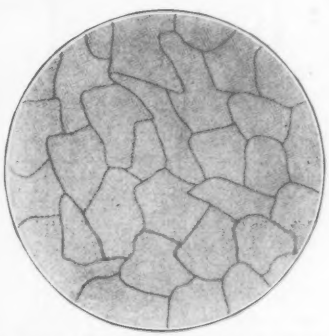


Fig. 11.—Microstructure of investment material condensed by vacuum and bonded without water of crystallization, while hot.

We can now see the principal reason why a difference in expansion is needed for different types of castings in ordinary investment materials. Naturally, difference in shapes and in tendency to straighten would necessitate difference in expansion; but, as I have previously shown, the same type of casting differences in bulk in the same casting and in other castings of the same shape would all alter the amount of stretch. It is virtually impossible for any one to estimate beforehand how much a given casting is going to crush the investment, so that attempts to produce dimensional accuracy by altering the expansion become an extremely uncertain means. Since the higher the fusing point of the metal, the more pronounced this effect becomes, it is completely impossible in the case of platinum.

As we have shown previously, it is, for many reasons, essential that platinum be cast into molds which are relatively much colder than is customary in gold casting. The spread between mold temperature and freezing point of the metal is at least 2000 degrees and frequently much more. Therefore, if we attempt to compound a platinum investment in the same manner as a gold investment, the unequal stretch becomes very noticeable to the naked eye even with the simplest of castings. We would not, of course, employ a plaster investment for such a high fusing metal since, at these temperatures, it would be converted to a glass about the consistency of molasses.

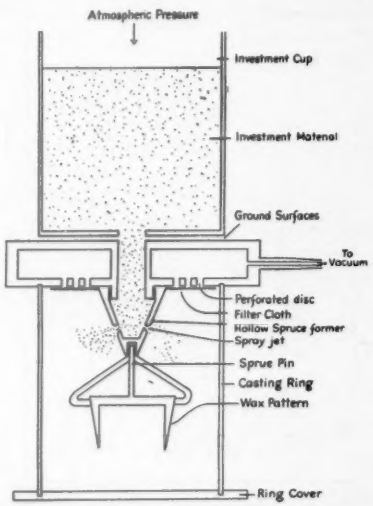


Fig. 12.—Automatic vacuum investing apparatus.

Suppose, as in the drawing of the photomicrograph in Figure 9, we could actually pack the particles of investment

material into close contact and, in addition, bond this mold by actual chemical union of the particles to each other: the cooling curve would be approximately the same as the heating curve, and we would have enormously increased the crushing strength of the mold. If heating is not carried beyond the refractoriness of the investment material, the cooling curve will be a constant. If the collapse which takes place in present-day materials is eliminated and no expansion or contraction takes place above the lowest casting temperature employed, since the shrinkage of the mold will always begin at the same point on the curve, we shall stretch every casting of the same metal over the same portion of its cooling range regardless of the mold temperature at the time of casting. If we raise the crushing strength sufficiently to stretch all parts of the casting uniformly, regardless of their bulk, we shall maintain the dimension of the casting from the freezing point of the metal down to the point where metal and mold can shrink together. In this case, since the mold cannot collapse, the casting shrinkage will be the same for all castings of the same metal.

In compounding a dental investment material, we are faced with three choices. If, in order to eliminate the stretch, we attempt to employ a soft mold which would permit free shrinkage of the metal, we find that such a mold will not withstand the casting pressure necessary for delicate intricate castings; all curved sections will straighten during cooling; the casting shrinkage will increase greatly, and the physical properties of metal cast in such a mold will not be so desirable. Furthermore, to fire a soft high expanding mold without cracking and disintegration would not be practicable under the conditions that are present in dental practice.

As we have seen, a moderately strong mold such as is used today stretches castings unequally, with resultant warpage and great variation.

Therefore, the only alternative is an extremely hard mold of high crushing strength with ability to uniformly stretch all castings, and a definite cooling curve which permits free shrinkage below the

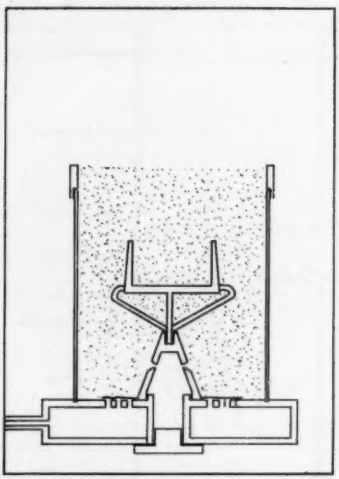


Fig. 13.—Condensing investment by vacuum after mold has been formed.

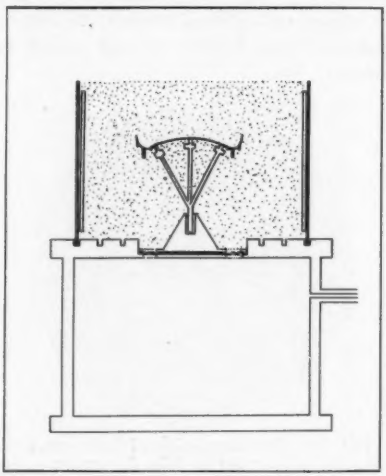


Fig. 14.—Vacuum condenser and dehydrator for large castings.

stretching point. We would, then, eliminate any necessity for guessing at the amount of expansion needed for any particular casting or any change in the fusing point of the metal provided it belonged to the same general class of alloys.

INVESTING

The investment material which I have described consists of a powder and a liquid. The amount of liquid necessary to produce the required plasticity is in excess of the chemical requirements of the mold. It is extremely difficult to remove air bubbles from any thick mix and, in addition, this investment possesses a high surface tension which tends to exaggerate this condition and makes application to the pattern difficult. Furthermore, for practical reasons, it is desirable to have an excess of the reagent, which must be removed after the mold has been formed. Therefore, for routine work, the most practical method employs the automatic vacuum investing apparatus illustrated in Figure 12.

The apparatus provides a means of creating a vacuum by water pressure within the casting ring and, after the vacuum has been created, spraying the investment material by atmospheric pressure into the casting ring. Since there is no air within the ring, there can be no air bubbles between the investment and the pattern. Furthermore, if the spray is a fine stream, the difference between the atmospheric pressure of the air bubbles in the investment and the vacuum within the ring will cause them to burst and be eliminated from the mix. The apparatus consists of a heavy sprue base with a circular opening in the center communicating with a tube connected with the hydraulic vacuum pump. Passing through the circular opening, but not communicating with it, is a tube on the end of which is a hollow sprue former containing two spray jets on the sides and an opening in the tip for the sprue. Placed over the circular opening is a filter cloth between two perforated disks to support it against the pressure of the investment, so that the air may be withdrawn, but the material cannot leave the ring. The opposing surface of the sprue former is accurately ground and fits a similarly ground surface on the bottom of an in-

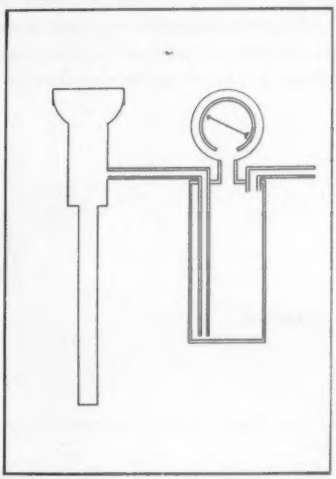


Fig. 15.—Vacuum pump operated by water faucet.

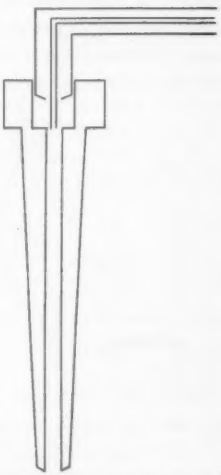


Fig. 16.—Special premix injector blow torch used to create powerful oxidizing conditions.

vestment cup. A cover is provided for the other end of the casting ring. The investment cup is movable and has a hole in the center through which the investment can flow into the hollow sprue former, continuing out through the spray jets. To aid in overcoming the high surface tension of the investment, the pattern is treated with a specially prepared wetting agent, which destroys the surface tension of the part of the investment that comes in contact with it. Since it has no surface tension, it cannot form a drop or ball, and so it must flow readily into every recess of the pattern.

The pattern is mounted in the usual manner with soft wax on the tip of the sprue former. Soft wax is placed in the grooves of the sprue base and ring cover

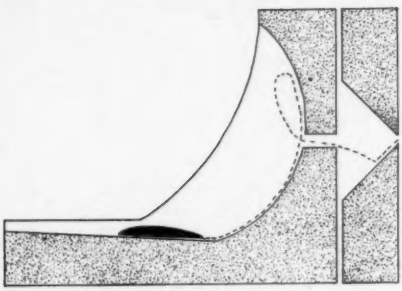


Fig. 17.—Path of metal in conventional crucible.

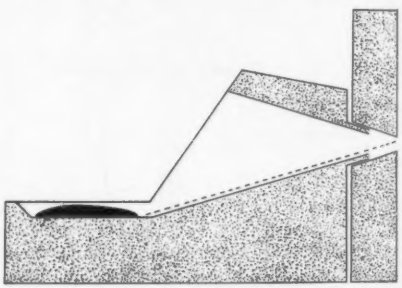


Fig. 18.—Path of metal in properly shaped crucible.

to create a vacuum seal; the ring is lined with a sheet of heavy asbestos, leaving an uncovered margin about one-quarter inch wide at both ends of the casting ring, and the apparatus is assembled as shown. Stopcock grease is placed on the two ground surfaces with the investment cup in eccentric position so that the hole through the sprue former and the bottom of the investment cup are each covered by the ground surface of the opposing part. The investment material is mixed to the proper consistency and poured into the cup. The vacuum is created in a few seconds, and, without removing the cup, the operator slides it to the center of the sprue former so that the two holes will coincide. Atmospheric pressure forces the investment material in the cup down into the sprue former and causes it to spray against the sides of the casting ring. The spray is not directed against the pattern since it might have sufficient force to cause distortion of a very light pattern.

When the investment has filled the ring, the cup is removed, a plug is placed in the spray tube, the apparatus is inverted and the ring cover is removed, as shown in Figure 13. The vacuum continues to operate and the excess liquid is withdrawn through the filter cloth and perforated disk. Since the investment material will condense very considerably as the liquid is removed, a short section of tubing is placed on top of the casting ring and more investment added so that the ring will be full when the mold is finished. At first glance, it would seem that atmospheric pressure would cause the investment material to distort the pattern; but, for some reason, the material begins to pack from the bottom of the ring toward the top. Since it is plastic, the pressure is equal in all directions, and the wax pattern being incompressible, no distortion takes place. As the liquid is removed, the suction causes the smaller particle to pack in between the larger crystals from the sprue former to the top of the casting ring, with the effect shown in Figure 11.

For large castings of partial dentures and for duplicate models, an apparatus slightly different in design but operating on the same principles is employed. As shown in Figure 14, it consists of a collector tank with a grooved cover to fit various sizes of casting rings, having a perforated center which is depressed so that the top of the mold will be above the top of the casting ring. It employs a sprue former of conventional design except that it has large perforations in the base to permit withdrawal of the liquid through a filter paper inserted between the sprue former and the perforated opening in the cover. The pattern is mounted on the sprue former as for gold casting. It is cleaned as usual, and the pattern dip is applied and sprayed with

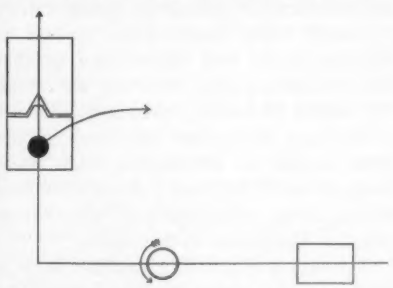


Fig. 19.—Lines of force of horizontal casting machine.

a heavy coat of investment material. The sprue former is placed over the filter paper, the asbestos lined ring placed in its proper groove and the balance of investment poured in to fill the ring. The vacuum is turned on and the excess liquid withdrawn as with the vacuum sprayer.

The vacuum for all of these devices is produced by means of the hydraulic pump illustrated in Figure 15. The pump consists of an aspirator which fits on a cold-water faucet, and a self-emptying bleeder tank with a vacuum gage. By providing the bleeder tank as part of the vacuum system with a capacity several times that of the casting ring, since the only part of the vacuum system which will be filled is the casting ring itself, the extra capacity of the bleeder tank serves as a booster to maintain the level of the vacuum within the casting ring, even though the volume of water flowing through the aspirator might not be sufficient.

MELTING METAL

The most important single item of equipment is the blowtorch. I cannot stress too strongly the part which it plays in the production of sound malleable gas-free castings. Platinum is a heavy sluggish metal which is not readily cast. In order to become sufficiently fluid, it must be carried far beyond its melting point, to a temperature of about 4000°. One might think that any metal at 4000° would be so hot that it would destroy any foreign matter coming in contact with it; but molten platinum is very easily

Fig. 20.—Line of force of vertical casting machine.

contaminated with foreign materials, the presence of which causes serious embrittlement of the casting, rough surfaces and subsequent gassing in the porcelain furnace. It is truly amazing what havoc can result from very slight contamination. Even the polishing dust in a laboratory would be sufficient to completely ruin a casting. Platinum readily absorbs carbon, hydrogen or refractory oxides, which might be reduced by an unsatisfactory blowtorch.

Manufactured or natural gas with oxygen is the preferred fuel. Oxyhydrogen may be used, but it is difficult to prevent some hydrogenation of the metal, causing a brittleness of the castings. There is, of course, some hydrogen in artificial gas, but it is possible to produce much stronger oxidizing conditions to overcome it.

For this purpose, we must employ a pre-mix low pressure injector type of blowtorch, operating on a principle similar to that of a saliva injector. Oxygen passing through a small injector under high pressure is suddenly expanded in a large mixing chamber. The sudden expansion creates a partial vacuum, which causes the low pressure gas to be drawn in, whence it passes to the tip to be burned. The few torches available which afford proper casting conditions are so large, unwieldy and expensive as to be impractical for our purpose. For that reason, it has been necessary to produce a special blowtorch the tip and injector of which represent a radical departure from conventional design and which we have found necessary to maintain extreme oxidizing conditions.

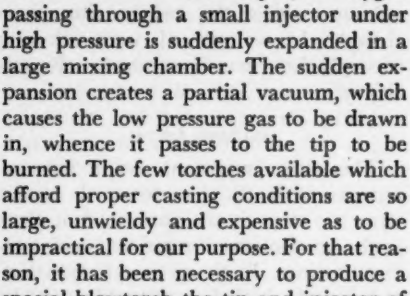


Fig. 21.—Photomicrograph showing mechanical union between fused porcelain and crystal structure of properly cast platinum.

THE CRUCIBLE

Figure 17 shows a cross-section of a crucible of conventional design. As stated previously, the metal is cast at a temperature of approximately 4000°. The design of the torch is such that the heat is concentrated upon the button of metal.

Although during melting the entire crucible becomes quite hot, the hood remains fairly cool in relation to the freezing point of the metal. As a result, after the casting has been made, it is found that the metal has followed the course shown by the dotted lines in Figure 17. When the machine starts, the inertia of the metal carries it along the curvature of the crucible and it lands against the hood with a splash. The important point is that each time the metal flattens in a splash and then is again gathered into a button, it has partially cooled and temperature differentials have developed within the mass. As previously stated, platinum is a heavy, sluggish metal presenting all possible resistance to accurate casting and therefore must be cast in the most fluid possible state. In relation to the crucible and mold, it has an extremely high melting point, and since it has a negligible melting range, it goes with extreme rapidity from the fluid to the solid state. It does not go through a mushy state as most casting golds do. In order to be sufficiently fluid to be cast into a cold mold, it must be brought to an extremely high temperature, beyond its melting point, and maintained in that fluid condition until it enters the mold. The delay in casting caused by the use of this type of crucible will result in cold shuts unless an abnormally high mold temperature is employed. As we have seen earlier, this will produce unfavorable physical properties in the metal.

The solution lies in a crucible such as is shown in Figure 18. The floor of the crucible is adjusted so that up to the instant of casting the molten metal remains at the back. As shown by the dotted line, the interior form of the crucible projects the metal in a straight line directly to the sprue opening. If the size and shape of the crucible and the sprue former have been properly balanced, the metal will not contact the sides of the sprue former, but will pass directly from the nose of the crucible into the sprue of the casting ring. Furthermore, as it traverses the crucible, it is maintained as a solid button, which is gathered into a column of metal. As it leaves the relatively cool nose, the more fluid center of the button passes through first, carrying the outer portions behind it. The actual casting, therefore, is made from the hottest, most fluid part of the

metal. This crucible is constructed of a highly aluminous clay, and the interior is covered with a thick layer of a highly refractory lining, which will withstand approximately 6000°. After repeated use, this lining undergoes a slight checking, but with reasonable care it will withstand about thirty meltings before any serious cracking occurs. No flux of any kind should ever be used in casting platinum, since it is impossible to oxidize the metal under our working conditions, and the flux itself would be injurious to metal, crucible and investment.

CASTING MACHINE

Figure 19 illustrates diagrammatically the lines of force involved in making a casting with the horizontal type of casting machine. The direction of rotation is counter clockwise. Regardless of the shape of the arm, the relation of the metal to the center of rotation determines the forces that will be exerted upon it when the casting machine starts. Since the force of inertia is equal to and opposite that of rotation, the metal is first thrown against the side of the crucible. Eventually, centrifugal force will operate to neutralize inertia and carry the metal in the direction desired. While this is not of great consequence with comparatively low fusing metals of wide melting range, such as casting gold, for the reason given in the previous discussion of crucibles it is very important in casting platinum. While it is possible to partially overcome this by means of a properly designed crucible, it does present an obstacle which is very likely to cause cold shuts unless the mold temperature is undesirably high. Figure 20 shows the lines of force of the vertical type casting machine. Here again, the same principles of physics hold true. The relation of the metal to the center of rotation determines the lines of force exerted upon it. The direction of rotation is clockwise. The force of inertia, therefore, tends to carry the metal against the floor of the crucible; but since the metal is already lying in that spot, it cannot splash or spin out. Since the metal cannot move by inertia, and it will not remain stationary, centrifugal force is exerted immediately to carry it in the desired direction. Furthermore, the machine must be equipped with a trigger release so that it will start with a real snap. This is of great importance since in the instant the machine snaps, the casting is made.

THE METAL

Cast platinum possesses one extremely important difference from the same wrought metal. During its manufacture, platinum is carried through a process of condensation at white heat, which tends to shatter its crystal structure and weld it into a more coherent mass. This results in a more malleable, tougher metal, which is more desirable for most purposes. The very dense surface which has been created has no mechanical adherence to porcelain. As we all know, wrought platinum can be readily peeled away from fused porcelain; but cast platinum presents an entirely different picture. It is harder and possesses a higher yield point than the same wrought metal, with a correspondingly lower elongation and tensile strength. The porcelain fused against such metal literally locks itself into the crystal structure, a strong mechanical union between porcelain and platinum resulting. Thus, the cast platinum framework becomes an actual strengthener for the porcelain. It is a well-known fact that while a wrought bar may strengthen the bridge as a whole, it provides a line of fracture and weakens the porcelain itself.

A cast platinum bridge covered with porcelain presents an almost perfect analogy to a human tooth. A tooth consists of a hard brittle enamel mechanically joined to a slightly resilient dentin. The enamel will crack and check, but it does not readily separate from the dentin. A cast platinum bridge consists of a hard

brittle porcelain mechanically joined to a slightly resilient metallic structure. It is possible by means of a blow to crack and check the porcelain, just as with the enamel on the human tooth, but it is impossible to peel it away from the metal. The mechanical union is so strong that the porcelain can be removed only by being ground away or dissolved in hydrofluoric acid. Figure 21 is a photomicrograph of a ground section of porcelain fused to a cast platinum coping. There is perfect contact between porcelain and platinum and a lack of any gassing, or checking in the porcelain. Similar examination of porcelain fused against wrought platinum reveals the fact that there is always an appreciable amount of gassing from the platinum, which in itself would prevent adherence and mechanical union and cause considerable checking of the porcelain.

This desirable property of the cast platinum is undoubtedly its most important feature. While it does possess some slight advantages over gold for general restorative purposes, of by far the greatest importance is the fact that it now makes possible all sorts of porcelain restorations which have heretofore been impracticable. Porcelain bridges made in this manner seem to possess all the desirable features of gold bridges without any of their drawbacks. An infinite variety of designs to fit the individual case are made possible, without the extreme difficulty and many failures experienced with wrought platinum. Over a period of several years, a large number of these bridges have been placed in service and, so far, breakage has been unknown. Undoubtedly, accidents will occur, but provision has been made in bridge design for easy repair.

SUMMARY

I have attempted to sum up the knowledge thus far gained of the general principles governing platinum casting. I would rather term this a progress report since undoubtedly some of the statements are open to discussion and further proof and there is still much to be learned.

Because of the unusual physical properties of platinum, it has been necessary to evolve a new technic, materials and equipment for casting it and its alloys. There is no dependable technic of casting. Success is dependent on a series of steps each of which bears a definite relation to those which have gone before. If one link of the chain is missing, failure will result. The knowledge thus gained has been applied to improvement and standardization of results, in all castings. Because the physical properties of platinum make it necessary to cast into a relatively cold mold and exaggerate errors present in the past system of gold casting, it has been possible to detect discrepancies and explain inequalities which have been known to exist, but have never been adequately explained.

It has been shown that attempts at dimensional accuracy by variation in expansion lead to corresponding variations in results. Variations in shrinkage are brought about by unequal stretching, and the collapse, upon cooling, of the plaster investments. Elimination of the collapse and creation of a constant cooling curve that always starts below the lowest mold temperature, coupled with a sufficiently high crushing strength, result in equal stretch of all castings, eliminate variations in net casting shrinkage and have uniform results. By following the principles outlined, an investment material can be compounded suitable for any metal in conformity with its physical properties.

I consider a thorough knowledge of the fundamental physical forces involved necessary to execution of the details of technic. Time has not permitted the inclusion of mechanical routine. I cannot foretell every problem with which we will be faced, but the man who understands clearly just what he is doing solves his problems automatically as they arise.

149 Prospect Avenue.

BONE REGENERATION FOLLOWING CONSERVATIVE ROOT CANAL TREATMENT

By J. A. Englander, D.D.S., Jersey City, N. J.

ONE of the most perplexing problems which face the dentist is the pulpless tooth with an involvement of the periapical tissues. This refers to teeth in apparent good health, which, when subjected to x-ray examination, were found to be non-vital and presenting evidence of a definite periapical infection. At one time, the most common form of treatment was extraction. Subsequently, conservative treatment followed by surgical intervention—apicoectomy—was employed to remove the infected bone after pulp-canal treatment was completed.

In this study, an effort has been made to determine when apicoectomy is necessary and when we might avoid its use in treating such teeth presenting periapical bone destruction. It must be noted at the outset that, when treatment was first started, no definite changes were made in procedure except as would normally have been employed before.

The cases treated were selected at random. Patients who presented certain unfavorable systemic conditions—diabetes, arthritis, etc., were not included. It must be stated, however, that those cases which were placed under observation were chosen only after the canals had been opened and treatment started. Since it was impossible to determine, from the x-ray evidence alone, the condition of the tissue in the canal—dry or moist gangrene—it was necessary to place a tooth under observation after the canal was opened and treatment begun.

The confidence in such treatment was derived from many sources:

1. X-ray films of teeth which originally had presented definite periapical infection and, after neglectful or haphazard checking, a number of years after routine pulp-canal procedure showed healthy bone subsequent to resorption of the infected area. Very often, asepsis was neglected. Moreover, many canals were poorly filled, either underfilled or porous.

2. Histologic studies showing that (a) new connective tissue and bone are laid down following the removal of sources of infection; and (b) areas of periapical infection consist of granulation tissue. Concerning the latter, Kronfeld[1] states that "its (granulation tissue) formation may be considered as the defensive or reparative reaction of the organism inasmuch as, in many instances, the granulation tissue initiates or precedes the healing of wounds."

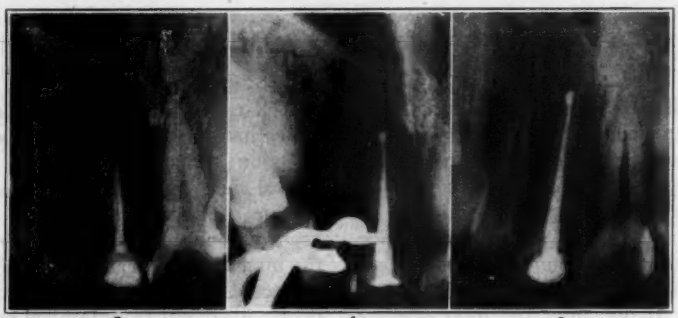
According to Kronfeld,

> Histologically, granulation tissue is composed of . . . fibroblasts; capillaries; inflammatory exudate cells; giant cells. . . .
>
> The fibroblasts do not, in a strict sense, take part in the inflammatory process; they have a reparative or regenerative function, such as incapsulating an inflamed area, replacing lost tissue, and forming scar tissue. . . .
>
> From the blood vessels solid sprouts of proliferating endothelial cells invade the forming granulation tissue; later they are transformed into true capillaries by being hollowed from within.

The exudate cells consist of leukocytes and polyblasts. Polymorphonuclear leukocytes are the main cellular constituents of pus.

In the later stages of inflammation, the leukocytes degenerate and disappear. . . . The function of polymorphonuclear leukocytes is the destruction of pyogenic microörganisms in the inflamed area. This is performed . . . (1) by phagocytosis and intracellular destruction of the bacteria, and (2) by a discharge of bactericidal and detoxicating substances. . . . Polyblasts . . . have the property of amoeboid movement, and migrate actively through the tissue. If they encounter bacteria or remnants of tissue decomposition, such as dead cells and fat granules, they engulf these remnants and store and digest them in their bodies. . . .

Giant cells are sometimes found in granu-



a b c

Fig. 1 (Case 1).—Case in girl, aged 18. a, case as presented, January 8, 1938, showing underfilled and poorly condensed filling. b, canal filled, February 9. c, results, September 7.

a b c

Fig. 2 (Case 2).—Case in girl, aged 17, involving upper left lateral and central incisors. a, appearance January 6, 1937; b, February 6; c, January 18, 1939. The upper left central incisor was suppurative; the upper left lateral incisor pulp vital but exposed. The pulp was ionized only once.

a b c

Fig. 3 (Case 3).—Case in man, aged 27; a, appearance December 10, 1935; b, December 17; c, August 17, 1938. Dry gangrene was present.

a b

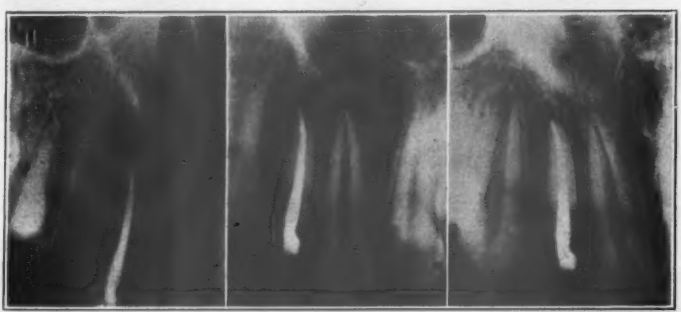
Fig. 4 (Case 4).—Case in boy, aged 11. a, appearance March 10, 1937; b, December 30, 1939. Both canals were suppurative. Porcelain jackets were placed in June 1939.

is rather resistant to dissolution, such as elastic fibers, blood pigment and calcified tissue. . . . if the infection in the root canal is controlled, the proliferation of connective tissue elements and the decrease of inflammatory cells will advance from the periphery toward the center until the entire granulation tissue is transformed into scar tissue and ultimately into bone. (Fig. 11.)

Since, therefore, in the cases treated before pulp-canal therapy was instituted, nature already has made an attempt to wall off and repair the infected area, the chances of success in our attempts did not appear too small.

a b c

Fig. 5 (Case 5).—Case in girl, aged 17. a, appearance January 3, 1938; cuspid filled, February 1; b, appearance November 14. The patient failed to return (for ten months) after treatment was started on the upper left lateral incisor; c, appearance January 23, 1939; showing reduction in size of area over both teeth.



a b c

Fig. 6 (Case 6).—Case in boy, aged 10. a, appearance February 25, 1938; b, March 2; c, February 9, 1939. Dry gangrene was present. A tooth had been broken in a fall, three months prior to institution of treatment. There was a history of swelling of the lip and jaw.

lation tissue, although they are not an essential component of it. . . . The function of giant cells is the elimination of material that

3. Experiments in which it has been shown that, after artificial infection of teeth (in dogs), resolution and regenera-

tion took place. Stein[2] exposed sound teeth, infected the root canals and sealed the teeth. After a few months, x-ray examination revealed periapical bone destruction. Pulp-canal treatment was then instituted, just as it should be carried out in the teeth of human beings, and completed without surgical intervention (apicoectomy). At intervals, roentgenograms taken to determine the condition of the area of rarefaction revealed a definite decrease in size, with subsequent disappearance. The animals were then killed and sections of the jaws were made. Stein demonstrated that new bone is built, and scar tissue forms at the root surface and over the filling material and round-cell infiltration disappears. The histologic findings around these infected and treated animal teeth are similar to those in human teeth with a similar clinical and radiographic history.

The fear in approaching this problem very often lay in the operator's doubts as to the possibility of eliminating the infection from the canal and sterilizing the infected area. The conclusion drawn from this fact is that success in treating such cases is impossible. Appleton,[3] however, has demonstrated the ability to

a b c

Fig. 7 (Case 7).—Case in man, aged 27. a, appearance March 21, 1936; b, March 30; c, March 4, 1939. Routine x-ray examination revealed the rarefied area over the left central incisor. Porcelain jackets had been placed about six years prior to initiation of treatment. The patient complained of a fistula which appeared frequently over the apex of the tooth. Treatment was accomplished through the porcelain jacket, which was left in place. a, root resorption; c, new peridental membrane with new cementum laid down on root (mesial surface).

a b c

Fig. 8 (Case 8).—Case in a woman, aged 35. a, appearance June 15, 1937; b, June 23; c, September 20, 1938. The rarefied area was discovered through a full mouth x-ray examination. There was no history of a blow, etc. Dry gangrene was present. Treatment extended over six visits.

sterilize the entire tooth structure and a large granuloma by means of electrosterilization.

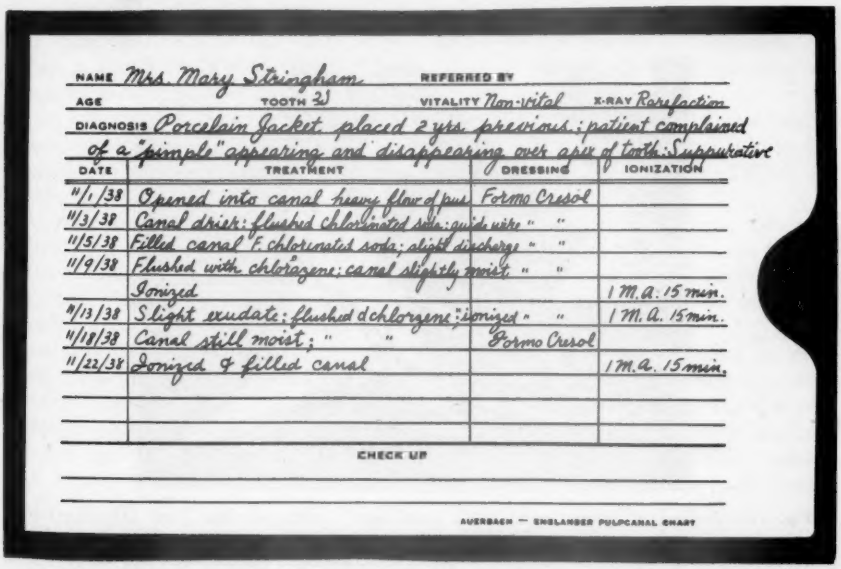
In this connection, I quote an eminent bacteriologist, Meyer Solis Cohen[4]:

I fail to see why more should be demanded of the dentist than of the surgeon, who does not completely sterilize the abscess he opens and drains. The germs that remain when the surgical abscess is allowed to close are finally destroyed by the patient's protective forces. Why cannot a similar fate befall the few germs that escape destruction in thorough canal treatment?

With or without definite sterility established, it does not seem too much to expect that, through natural forces of the body, resorption of the infected area and regeneration of bone would logically follow.

a b c

Fig. 9 (Case 9).—Case in a girl, aged 18. a, appearance October 27, 1937; b, November 15; c, May 18, 1938.



NAME Mrs. Mary Stringham REFERRED BY

AGE TOOTH 21 VITALITY Non-Vital X-RAY Rarefaction

DIAGNOSIS Porcelain Jacket placed 2 yrs. previous; patient complained of a "pimple" appearing and disappearing over apex of tooth: Suppurative

DATE	TREATMENT	DRESSING	IONIZATION
11/1/38	Opened into canal heavy flow of pus	Formo Cresol	
11/3/38	Canal drier: flushed Chlorinated soda: guide wire " "		
11/5/38	Filled canal F. chlorinated soda; slight discharge " "		
11/9/38	Flushed with chlorazene; canal slightly moist " "		
	Ionized		1 M.A. 15 min.
11/13/38	Slight exudate: flushed d chlorazene; Ionized " "		1 M.A. 15 min.
11/18/38	Canal still moist; " "	Formo Cresol	
11/22/38	Ionized & filled canal		1 M.A. 15 min.

CHECK UP

AUERBACH — ENGLANDER PULPCANAL CHART

Fig. 10.—Envelope chart recently devised by Dr. Auerbach and author for convenience in checking cases.

Appleton[3] adds an interesting quotation from M. L. Rhein:

A great many dentists have been unduly frightened by reports of organisms being found in some cases of regenerated alveolar process. As we now are constantly finding such bacteria not only in freshly exposed pulps, apparently healthy, but also in the periapical region of teeth with living pulps, such fears are groundless.

The considerations which governed the decision to treat infected cases in this manner, which will be described later, were as follows:

1. The age and health of patients. Treatment of pulpless teeth with periapical bone infection depends a great deal on the natural resistance of the patient. Therefore, only young persons and those free from any systemic condi-

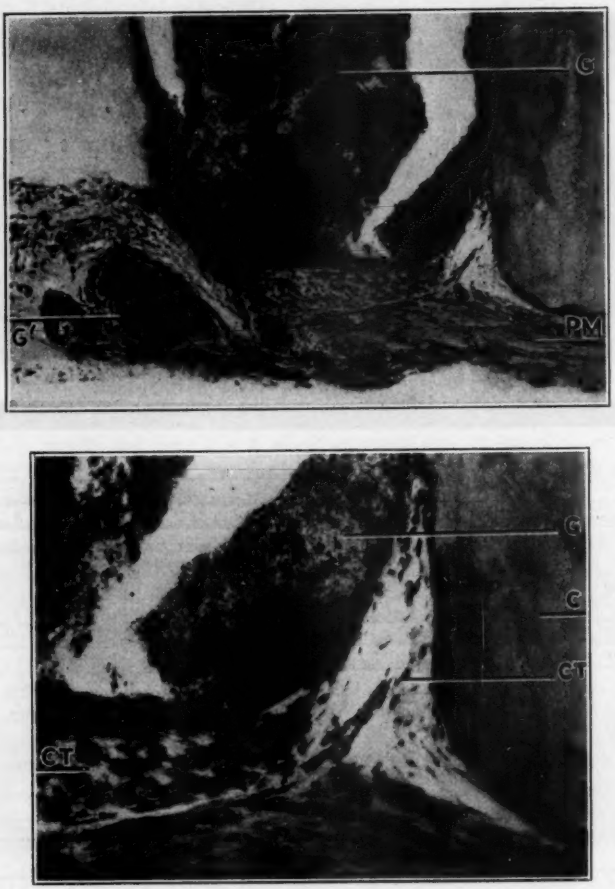


Fig. 11.—Section of lower cuspid tooth (and bone) extracted nine years after treatment. Originally, rarefaction was present. The tooth was treated by a conservative root-canal procedure. G, gutta-percha in root-canal. G', particles of gutta-percha dislodged beyond periapical foramen. CT, fibrous connective tissue of periodontal membrane (PM) lying in direct contact with gutta-percha and wall of root-canal. The absence of any inflammatory reaction in the periapical connective is evident. (Courtesy of E. D. Coolidge.)

tions were placed under observation in this category.

2. The condition of the rest of the mouth. Since lowered resistance in and about the mouth might impede the healing process, it was advisable to accept for such treatment only teeth in clean, healthy mouths.

3. The anatomy of the root canal. The technic employed demands filling the root canal up to or beyond the apex. When the canal was found to be too tortuous to negotiate, or with an obstruction at or near the apex, precluding the prescribed filling, such treatment was excluded. It will be found in the accompanying illustrations that in the great majority of cases, there was only one canal. Because of the possible presence of accessory canals in multirooted teeth, which it is difficult to clean satisfactorily, it was found advisable only in certain cases to attempt conservative treatment.

4. The condition of the tooth itself. When a tooth was found to be broken down to such an extent that application of the rubber dam, which is essential, was extremely difficult or impossible, the advisability of treating the tooth was questioned, as it was also when, even with the use of rubber dam to keep the operating field dry, it was impossible to restore the tooth to function.

5. Extent of the periapical lesion. It was decided that the treatment of teeth with periapical lesions should include only those involving one or two teeth. Perhaps, at certain times, treatment of two or more teeth involved in one large periapical rarefied area might be attempted, but it was feared that, in most cases, there might be too much of a drain on the body. Particular care was observed when the apices approached or penetrated the floor of the antrum, for fear, if unsuccessful, of infecting the antrum.

SUMMARY AND GENERAL CONSIDERATIONS

1. Extreme care must be exercised in attempting root-canal treatment.

2. Strict surgical asepsis must be maintained at all times.

3. Use of rubber dam is indispensable.

4. Mechanical cleansing of the canal plays a most conspicuous part in root-canal treatment. The limited use of certain medicaments as aids in cleansing canals is a helpful adjunct.

5. Complete removal of all organic material must be accomplished.

6. The bases of diagnosing such cases for successful treatment are the following considerations: (a) The age and health of the patient must be favorable. (b) The mouth must be in a healthy state. (c) The shape of the root-canal must be such as to permit easy access, complete removal of organic material and compact root-canal filling to or slightly beyond the apex. (d) The tooth must be in such a condition that, after successful root-canal treatment, it can be restored to function. (e) The periapical lesion should not be too extensive. (f) The patient must be understanding and cooperative.

7. Direct access must be obtained to permit easy manipulation of instruments both for filing and for filling the canal.

8. After treatment is begun, the canal, between sittings, should always be well sealed, with temporary stopping and baseplate gutta-percha, or temporary stopping and cement.

9. The canal filling should be dense and it should reach the apex or extend slightly beyond it. In Figure 1, the original canal filling (a) is porous and also short of the apex. The filling material consists of chlora-percha and gutta-percha.

10. Ionic medication plays an important rôle in treating these cases. The canal is ionized at least twice and sometimes more often. The filling should be placed immediately after ionic medication.

11. Treatment of these cases should never extend beyond a few weeks. A

need to extend it beyond this time may be indicative of a chronic periapical infection, which could be successfully treated only by resorting to apicoectomy.

12. Teeth with periapical involvement can be treated successfully by routine conservative root-canal procedure. In addition to satisfying the foregoing requirements, the canal prior to filling must be dry and odorless and must present clean, hard pulpal walls.

13. All teeth with periapical involvement cannot be successfully treated as described above.

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2616 Boulevard.

ORAL AND ROENTGENOGRAPHIC ASPECTS OF THE TEETH AND JAWS OF JUVENILE DIABETICS

By C. E. RUTLEDGE, D.D.S., San Francisco, Calif.

THE etiology and pathogenesis of paradentosis is still obscure in many respects. The vast number of theories regarding interpretation of early changes in the paradental tissues have not clarified the etiologic concept satisfactorily as yet, and the final answer has not been obtained as to (1) whether paradentosis is primarily of local origin, (2) whether it always manifests itself in conjunction with certain systemic or constitutional diseases or (3) whether, as the "fusionists" believe, both local and constitutional factors must be present to bring about definite paradental manifestations.

It has been widely recognized that certain systemic conditions are accompanied by definite oral manifestations, which are sometimes evident before other clinical symptoms of the disease can be observed; as, for instance, scurvy and blood dyscrasias. It has long been suspected that endocrinopathies, in particular diabetes mellitus, are frequently associated with paradentosis.

Although the literature has been filled with descriptions of clinical observations of the coexistence of paradentosis and diabetes since the earliest work of Seiffert[1] (1862), Schmitz[2] (1881), Magitot[3] (1882) and Bonieux[4] (1883), most reports as to the frequency of coexistence of the two conditions contradict one another. This discrepancy appears to be due primarily to the fact that different approaches were chosen by the investigators. Some of them tried to establish the frequency of diabetes in a group of paradentosis patients selected at random, and others studied the frequency of paradental diseases of diabetic patients. The first approach offers many pitfalls. Every investigator must employ a definite classification of paradentosis, including

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From the George Williams Hooper Foundation for Medical Research and the Division of Dental Medicine, College of Dentistry, University of California.

either all or only specific types, after the patient material is properly filtered and grouped. It is obvious that the data derived from the various studies cannot be compared if, for instance, one investigator examines a group with a predominant number of so-called "filth pyorrhea" cases, while another uses a group of patients with a predominant number suffering from a "dystrophic" type of paradentosis.* The incidence of diabetes probably would differ greatly in such groups.

It has been stated on numerous occasions that in diabetes the oral aspect may be of great importance in early recognition of the disease. The outstanding symptom is a typical fruity odor of the breath, resembling decaying apples, new

Fig. 1.—Paradental condition of patient, M. H., boy aged 17, with diabetes, xanthomatosis and tuberculosis; showing marked pocket formation and horizontal and vertical atrophy between right upper central and lateral incisor.

hay or acetone, and called "diabetic breath." It was first recognized by Brand[5] in 1850. In 1857, Peters showed the condition to be due to acetone in the blood as a consequence of the formation of certain fatty acids resulting from impaired carbohydrate utilization. Owing to the lowered general resistance of the diabetic patient, gums develop a tendency to hemorrhage, and as a result of this marginal gingivitis, which usually progresses, involving deeper parts of the paradental tissue, the teeth become loosened. This leads to paradentosis and sometimes paradental abscesses. These findings are corroborated by Aiguier,[6] Beardwood,[7] Rhein,[8] Gescheff,[9] Niles,[10] Comroe, Collins and Crane,[11] Schour,[12] Williams[13] and Citron.[14]

Many authors seem to agree that paradental manifestations are pathognomonic for diabetes. Only recently, Hirschfeld[15] reported in great detail oral manifestations in adult diabetes. He believes that there are definite paradental symptoms associated with diabetes: (1) the acute paradental abscess and (2) the sessile or pedunculated proliferations or polyps that protrude from under an abnormally heavy, usually unbroken, gingival margin, which they force away from the tooth surface.

Fig. 2.—Roentgenogram of case shown in Fig. 1; atrophy between incisors.

The most comprehensive report was submitted by Kent,[16] who studied 5,000 diabetics and divided them into the following groups: (1) under 20, (2) from 20 to 50 and (3) over 50. A child, in group 1, who has been on a rigid diabetic diet during the years of tooth development is usually free from caries, but shows a marked tendency to tartar formation. The latter is true also of older persons. In appearance, the soft tissue is not unlike that of a normal healthy child, the gums being pink and free from lesions. Patients in group 2 usually have many carious teeth showing marked resorption of alveolar bone structure, pocket formation and pus. The members of group 3 are largely edentu-

*See classification adopted at the Eighth International Dental Congress, Paris, 1931.

lous. They usually report that the teeth loosened years before the diabetes had been diagnosed.

Many clinical descriptions can be found which state that the mucous membrane is deep red and very dry. The patient complains of a persistent thirst and constant burning. The tongue may be enlarged. It looks raw and red and shows enlargement of fissures. Various reports indicate that there is no sugar in the saliva of a diabetic patient. The teeth are usually coated with a soft light yellow tartar, which forms rapidly and is supposed to be due to the acidosis. The large output of alkali through the urine is accompanied by a proportionately large output of calcium through the saliva, which causes a rapid formation of tartar (Prinz and Greenbaum[17]).

In adults, Roth[18] found among fifty-one diabetics thirty (i.e., 60 per cent) with paradentosis. All of these patients were over 40 years of age.

Zilz[19] collected statistics regarding 100 diabetics in Vienna, of which seventy-one were found to suffer from paradentosis. The percentage was higher in women than in men. In 47.9 per cent of these cases, paradentosis had preceded diabetes; in 9.8 per cent, paradentosis immediately followed diabetes, and in 25.3 per cent, paradentosis appeared simultaneously with diabetes; which indicates strongly the possibility that paradentosis is pathognomonic for diabetes. In five patients of 16 years or younger, Zilz observed no paradentosis.

Ersner[20] states that 95 per cent of all patients with diabetes have caries and paradentosis. He says, "Paradentosis is present in a large proportion of diabetics, but not universal; in my opinion, it is more prevalent in diabetes than in any other systemic disease."

Weichert's[21] examination of fifty diabetics under treatment included a study of dental roentgenograms. He found paradentosis in 68 per cent, or 34 patients. (Table 1.)

In additional cases, the roentgenograms also showed the beginning of bone atrophy with enlargement of marrow cavities and widening of the peridental membrane spaces, which could be considered preparadentotic. The remaining six cases had normal bone. In most of Weichert's[21] cases, the inflammatory symptoms predominated. He states definitely that no juvenile diabetics gave evidence of paradentosis.

Fig. 3.—Roentgenogram of case shown in Figures 1 and 2; atrophy of lower posterior area.

Fig. 4.—Roentgenogram of case shown in Figures 1-3; atrophy of lower posterior area.

Butz[22] found among sixty-seven cases of diabetes, only sporadic paradentosis. However, this author observed gingivitis together with a greater degree of osteoporosis in nearly all cases, but did not designate it as paradentosis. Since, considered by more rigid standards, these cases might be classified as paradentosis, her report tends to support the theory of a connection between diabetes and paradentosis.

An example of the difficulty of finding a connection between diabetes and paradentosis is shown in the work of Boenheim,[23] who reversed the procedure and examined a number of patients with

paradentosis. He found among 114 cases of paradentosis, selected at random, only one patient with diabetes. He states: "There is no close connection between diabetes and periodontitis." Table 2 (from Boenheim's report) gives a summary of the findings of fourteen authors.

It can be noted from Table 2 that a total of 1,575 cases of paradentosis were examined by these authors. Only the comparatively small number of 225, or 14.3 per cent, gave evidence of diabetes. However, it must be realized that this table has only relative value because a clear classification of the various possible types of paradentosis was not made by most of the investigators quoted.

Opinions similar to that expressed by Boenheim can be found in the reports of Badanes[24] and Scheff.[25]

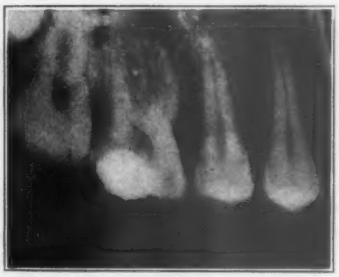

Fig. 5.—Large crowns and small roots in J. K., girl aged 13. This condition is found in many cases of juvenile diabetes.

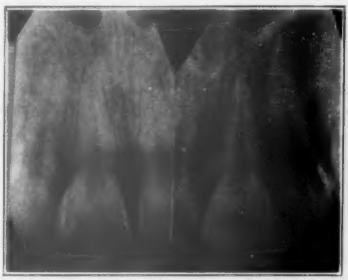

Fig. 6.—Large crowns and small roots in S. S., girl aged 14; a common condition in juvenile diabetes.

DENTOMEDICAL EXAMINATIONS OF TWENTY JUVENILE DIABETICS

If the metabolic unbalance found in adult diabetics is responsible for paradental manifestations, paradental lesions should also occur before maturity; i.e., in juvenile diabetic cases. It is not difficult to surmise why an adult with diabetes of long standing is susceptible to paradentosis. The influence of acidosis, dehydration and the added factor of lowered resistance to infection are sufficient. It must be suspected that in children the tissue resistance against local paradental disease is much higher than in advanced life, and for this reason paradentosis may not occur.

Stein[26] in 1934 found among sixty-two diabetic children, eighteen who had paradentosis; but this may be explained by the fact that in the eighteen diabetics, five were between the ages of 15 and 18 years, and six were over 18, or were adult. Zilz reported finding no paradentosis in patients 5 to 15 years of age. Sheppard,[27] in a roentgenographic study of thirteen patients, aged 8 to 19 years, found little or no bone resorption, except one severe case. The patients were all hospitalized diabetics, who were classified according to age, sex, duration of disease and severity. Hilming[28] reported one case of the inflammatory type of paradentosis and eight cases of marginal gingivitis in a group of ten juvenile diabetics between the ages of 10 and 20 years.

These investigations indicate that there is considerable difference of opinion as to whether gingival or paradental diseases occur frequently in juvenile diabetics.

In studying a possible relationship between gingival and paradental disturbances and juvenile diabetes, the following examinations were made:

1. Evaluation of the medical records.*

*These were placed at the author's disposal through the courtesy of the Pediatrics Department of the University of California.

2. Clinical examination of inflammatory conditions and other abnormalities of the oral cavity or jaws.

3. Complete roentgenographic study of jaws and teeth.

Twenty children between the ages of 8 and 19 years (Table 3) in the care of the Pediatric Department of the University of California were studied.

The data of Table 3 reveal that the children were under treatment for diabetes from one to ten years. The therapy was essentially insulin injection and a strict dietary regime. All patients cooperated in their treatment with the exception of No. 13 and No. 10, who presented difficult behavior problems. The diabetic condition of the twenty patients at the time of oral examination appeared to be favorable in all cases and was considered "stabilized."

Today, it is generally accepted that the inheritance of diabetes occurs as a mendelian recessive trait. Comroe, Collins and Crane,[11] however, state that only five histories of these twenty children gave evidence of other cases of diabetes in the family. (Table 3.)

The dental study of these twenty patients included a determination of the life caries index (Bodecker) and clinical and roentgenographic examinations of the teeth and their surrounding structures. The findings, summarized in Table 4, reveal the interesting fact that three of the children were entirely caries-free, while eleven patients had lower than the average life caries index* for their respective ages. These findings seem to confirm the work of Bunting[29] and Jay, who consider an increased carbohydrate intake and consequent development of *Bacillus acidophilus* the main etiologic factors in dental caries. The restricted carbohydrate diet of these patients, therefore, may account for a low caries incidence in these fourteen patients (70 per cent).

Even though detailed data are not given here as to occlusion and articulation, it was observed that no local factor, such as overstress, missing contact points and loss of teeth, could be made responsible for paradental lesions. As far as the clinical appearance of the paradental structure is concerned, it was found (Table 4) that, in most instances (sixteen cases), the gum tissue was of normal color. In four instances, the mucous membrane of the free margins of the gum tissue appeared red and puffy and paradental pockets had formed. Surprisingly enough, a roentgenographic check of the teeth and jaws revealed that, in ten additional instances, slight vertical and horizontal atrophy of marginal bone structure could be observed. (Table 4.) In seven instances, soft or hard deposits were found, which appeared to be partly due to poor mouth hygiene.

In one case, the diabetic condition was

TABLE 1.—FREQUENCY OF PARADENTOSIS IN DIABETIC PATIENTS (WEICHERT)

Age	Sex		Total	Normal Bone Structure	Preparadentotic Gingivitis	Paradentosis
	Female	Male				
5—12	3	1	4	4	—	—
15—20	5	—	5	1	2	2
20—30	11	4	15	1	5	9
30—40	4	7	11	—	1	10
40—55	9	6	15	—	2	13
Total	32	18	50	6	10	34

*The average life caries indexes, as established by Bodecker, have been included in Table 4 for comparative purposes.

complicated by tuberculosis and xanthomatosis (Case 17*).

The upper right central and lateral incisors were separated, extruded and loose. Between them, a bulging reddish granulomatous mass, soft to the touch, with pus exuding at the free gum margin on pressure, was seen (Figs. 1, 2).

The right upper first molar and the lower right and left first molars were loose and the free margin of the gum was reddish and thickened. Pus was exuded on pressure. Roentgenograms (Figs. 3, 4) showed extensive horizontal and vertical atrophy in these areas. This case of paradentosis and diabetes, which is far advanced at 17 years of age, must be considered from another interesting viewpoint; namely, the patient also suffered from xanthomatosis. In 1931, Gescheff[9] reported the presence of lipoids in paradental tissue in cases of diabetes after Berberich[30] had found that, in nearly all cases of diabetes, a hypercholesteremia of the blood existed. In the course of his histologic examinations of gum tissue and paradental granulation tissue of diabetic patients, Gescheff noted in five out of six cases round-cell infiltration in the subepithelial connective tissue, with an abundance of fatty depositions. He concluded that these fatty infiltrations in the inflamed paradental tissue were the result of the diabetic lipemia, which lowers the resistance and decreases the healing tendency of paradental lesions. According to Gescheff, these anatomic findings seem to explain the predisposition or constitutional tendency to paradentosis.

TABLE 2.—FREQUENCY OF DIABETES ACCOMPANYING PARADENTOSIS (BOENHEIM)

Author	No. of Cases of Paradentosis	Diabetes Mellitus	
		No. of Cases	Per Cent
Askanazy	62	2	3.2
Belejkin	36	1	2.8
Boenheim	114	1	0.9
Breuer	80	2	2.5
Citron	100	2	2.0
Landgraf	150	1	0.7
Loos	200	7	3.5
Maranon	224	17	7.6
Morelli	100	8	8.0
Nothmann	50	5	10.0
Reynolds	36	8	22.2
Sachs	200	6	3.0
Williams	138	81	59.0
Wisotzky	85	85	100.0
Total	1 575	226	14.3

Schroff described a similar case of xanthoma, or Schüller-Christian disease. He states:

> This disease belongs to the group of diseases characterized by a constitutional disturbance of lipoid metabolism that leads to an overflow of lipoid substance into the blood. In an effort to rid the blood of excess lipoid, certain cells of the reticulo-endothelial system and histiocytic system ingest and store the fats. The areas so affected become the site of granulomatous masses, resembling malignant tumors, and because of their destructive influence on certain organs and tissues, a characteristic clinical syndrome is produced. The presence of these granulomatous masses in bone causes a local osteoporosis due to direct pressure of the masses on the trabeculae. This occurs frequently with diabetes.

As stated previously, the roentgenographic study of teeth and jaws disclosed that many more cases (ten) showed marginal, vertical and horizontal atrophy than was originally suspected on the basis of clinical examination alone. All findings are summarized in Table 5, and it can be observed that, in six instances (Cases 6, 7, 9, 16, 19, 20), the gum tissue appearance was normal, while roentgenographically definite horizontal and vertical atrophy was found. Furthermore, a distinct widening of the peri-

*Because of the nature of this investigation, it was impossible to obtain accurate data as to how long these oral conditions had been present. The dental treatment was started, in most instances, immediately after the oral examination.

dental membrane space in the marginal part of the paradentium was noted, although clinical symptoms were absent (Table 5, column 15). A comparative study of all dental roentgenograms obtained in these twenty cases showed in a large number of cases (eighteen) (columns 6, 7) a decided disproportion in sizes of crowns and roots.

In general, the bone structure showed normal distribution of bone trabeculae, although, in four cases (8, 13, 14, 15), the jaw bone structure appeared definitely porotic. Case 16 had an exceptionally dense jaw bone structure. Pulp stones were found in only five cases, while apical infections, partial anodontia (undeveloped third molars) and a few instances of root resorption were coincidental findings.

TABLE 3.—MEDICAL STATUS OF TWENTY JUVENILE DIABETICS*

No.	Patient	Sex	Age	Age at Onset	Age Treatment Started	Hereditary Tendency
1	GT	♀	8	2	2	Yes
2	SW	♀	9	9	9	Yes
3	BK	♀	10	3	3	—
4	LS	♂	11	6	6	—
5	MJ	♀	11	9	9	Yes
6	JE	♀	12	3	3	—
7	JB	♀	13	7	7	—
8	MS	♀	13	12	12	—
9	JK	♀	13	10	10	—
10	DD	♀	14	14	14	Yes
11	SS	♀	14	8	8	—
12	DS	♂	14	5	5	—
13	EA	♀	15	14	14	—
14	CR	♀	15	11	11	—
15	BM	♂	16	9	9	—
16	MD	♀	17	16	16	—
17	MH†	♂	17	7	7	—
18	GH	♂	18	11	11	Yes
19	FE	♀	19	13	13	—
20	BM	♀	15	10	10	—

*All cases were under insulin and dietary therapy and all were sugar free and were considered stabilized.
†Case complicated with tuberculosis, Froelich's syndrome and xanthoma of mandible and maxilla.

CONCLUSIONS

The clinical and roentgenographic study of twenty diabetic children between the ages of 8 and 18 revealed that gingival and paradental disturbances are very frequently present. In 80 per cent (sixteen cases), definite symptoms of gingivitis, marginal vertical and horizontal atrophy and also marginal widening of the peridental membrane space could be found, alone or together. This seems to indicate that the oral aspect of juvenile diabetes constitutes a very important and early symptom of this systemic disease. It further emphasizes the importance of dental advice for the pediatrician. If he seeks and obtains adequate dental therapeutic care for his patient, the progress of an inflammatory tendency may be arrested, and subsequent loss of alveolar structure, which ultimately leads to a loosening and exfoliation, may be avoided.

The early findings of Hilming, Scheff, Zilz and Sheppard, among others, could not be confirmed by the foregoing study. Roentgenographic examination appears

TABLE 4.—ORAL EXAMINATIONS OF TWENTY JUVENILE DIABETICS

No.	Patient	Sex	Age	Life Caries Index	Average Life Caries Index for Age	Clinical Appearance of Paradental Structure	Remarks
1	GT	♀	8	Caries free	2.92	Calculus, teeth stained, gingivae normal	
2	SW	♀	9	2.5	2.92	Gingivae normal	
3	BK	♀	10	Caries free	8.16	Gingivae normal	
4	LS	♂	11	14.375	7.35	Slight gingivitis, stains on lower anterior teeth, calculus, gum tissue normal	Mouth hygiene poor
5	MJ	♀	11	3.75	8.16	Gingivae normal	
6	JE	♀	12	1.875	8.16	Gingivae normal	
7	JB	♀	13	1.25	8.16	Gingivae normal	
8	MS	♀	13	15.0	8.16	Gingivae normal	
9	JK	♀	13	Caries free	8.16	Gingivae normal	
10	DD	♀	14	21.25	8.16	Calculus on lower anterior teeth, some gingival recession of lower anterior teeth, gingivae normal	Mouth hygiene poor
11	SS	♀	14	11.25	8.16	Slight stains on teeth, gingivae normal	
12	DS	♂	14	3.75	7.35	Gingivae inflamed and detached between lower right central incisor and cuspid, lower left first molar, pus on pressure	Mouth hygiene poor
13	EA	♀	15	20.625	12.54	Calculus lower anterior teeth, slight gingivitis throughout mouth	
14	CR	♀	15	5.0	12.54	Gingivae normal	
15	BM	♂	16	8.125	12.25	Gingivae normal	
16	MD	♀	17	12.5	12.54	Gingivae normal	
17	MH	♂	17	3.125	12.25	Upper central and lateral incisors separated, overgrowth of tissue, pus, lower molars loose, lingual gingivae inflamed	Lesions of gingivae diagnosed as xanthoma
18	GH	♂	18	9.375	12.25	Calculus lingual lower teeth, gingivae normal	
19	FE	♀	19	4.375	12.54	Gingivae normal	
20	BM	♀	15	1.875	12.54	Gingivae normal	

TABLE 5.—ROENTGENOLOGIC STUDY OF TEETH AND JAWS OF TWENTY JUVENILE DIABETICS*

No.	Patient	Sex	Age	Diabetes (Years)	Crown and Root Form		Bone Structure	Marginal Atrophy		Pulp Stones	Apical Infections	Partial Anodontia	Root Resorption	Peridental Membrane Widening	Remarks
					C	R		H	V						
1	GT	♀	8	6	L	—	N	—	—	—	—	—	—	Too young	
2	SW	♀	9	1	L	—	N	—	—	—	—	—	—	No	
3	BK	♀	10	7	L	—	N	—	—	—	—	—	—	No	
4	LS	♂	11	5	L	—	N	—	—	—	2 | /	—	—	Yes	
5	MJ	♀	11	2	L	—	N	—	—	—	—	—	—	Yes	
6	JE	♀	12	9	L	—	N	Slight	Slight	—	—	—	21 | 12 /	Yes	Gingivae normal
7	JB	♀	13	6	N	P	N	Slight	Slight	—	—	| / 7 |	| / 1 | 34	Yes	Gingivae normal
8	MS	♀	13	1	L	—	O	—	—	—	—	—	—	No	
9	JK	♀	13	3	L	P	N	Yes	—	—	—	8 | /	—	Yes	Gingivae normal
10	DD	♀	14	1	L	P	N	Yes	Yes	—	—	—	—	Yes	
11	SS	♀	14	6.	L	Short-P	N	—	—	—	—	—	—	Yes	
12	DS	♂	14	9	L	P	N	Yes	M	76 | 6 / 76 | 67	—	—	| 1 /	Yes	
13	EA	♀	15	1	L	P	O	—	Yes	—	1 | /	—	—	Yes	
14	CR	♀	15	4	L	P	O	—	—	—	—	—	—	Yes	

14	CR	♀	15	4	L	P	O	—	—	—	—	—	Yes		
15	BM	♂	16	5	L	Long	O	—	—	—	8 | 8 8 | 8	—	No		
16	MD	♀	17	1	L	—	N	Slight	—	Small molar	8 | 8 8 | 8	—	Yes	Gingivae normal	
17	MH	♂	17	10	L	—	N-Dense	—	M	6 | 6 | 6	8 | 8 8 | 8	4 | 45 54 | 45	Yes	Xanthomatosis	
18	GH	♂	18	7	L	—	N	—	—	Molar	8 |	—	Yes		
19	FE	♀	19	6	L	—	N	Yes	Yes	—	—	—	Yes	Gingivae normal	
20	BM	♀	15	5	N	—	N	Slight	Slight	M	—	—	No	Enamel hypoplasia	

*C, crown; R, root; L, large; P, pointed; N, normal; O, osteoporosis; M, marked.

indispensable in determining whether there is paradental involvement. Perhaps the lack of this aid to diagnosis may explain the failure of Scheff and Zilz to find any paradental disturbance in juvenile diabetics.

The presence of definite paradental disturbances in diabetic children as young as from 11 to 15 years suggests an aspect of paradentosis frequently ignored by dental and medical practitioners. It also suggests that these conditions progress with advancing age and explains the observations of previously mentioned authors who state that paradentosis is pathognomonic for adult diabetes.

Breuer's[21] statement that practically all systemic diseases, including diabetes, have definite oral manifestations, among which a marginal gingivitis predominates, and that a deeper involvement of paradental tissue (paradentosis) develops only if an additional local disturbance occurs, cannot be confirmed by this investigation because localized overstress, missing contact points or loss of teeth could not be held responsible for the paradental lesions.

Because the hereditary tendencies of diabetics follow Mendel's law, the history of every patient suffering from paradentosis should include an inquiry into the endocrine background of the family.

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REVIEW OF THE ORTHODONTIA PROBLEM

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WE are told that human intellect has not changed appreciably during the few thousand years of recorded history. "The Conquest of Life," by Theodore Koppanyi, tells us that the intelligence quotient of the average Athenian citizen must have been about that of the man of the streets of our own day.

Even though Greek philosophers centuries before Christ were equipped with great mental powers which are not likely to be surpassed in any age, our capacities for enlightenment have improved over those of the ancient civilized people because alert minds have handed down to future generations their findings and discoveries of interesting facts about man and his universe. The Greek pioneers in thought and research inherited the manifold problems awaiting solution, while the man born today comes into a huge inheritance with a fund of facts laboriously gathered for years and years. This accumulated knowledge of tens of centuries is called science.

The scientist seldom takes for granted truths or laws as we know them without experiment or considerable observation on his part. The great discoveries of science have enabled men to enjoy greater material comfort through better living conditions and improved health through better knowledge of the human mechanism and its care.

The study of stars and the paths of comets might seem to some a little more awe-inspiring, or chemistry and physics, with their atomic and molecular phenomena, more fantastic, than the study of biology; but what science offers such a variety, such a multitude of problems in their intricate organization as the science that deals with the knowledge of living organisms, plants and animals? For instance, what is more interesting or more variable than life from its smallest form, the ameba, to its most complex form, man? The same functions are performed by all. Food is taken in and digested to build up its body. It eliminates waste products. It respires, in that it takes up oxygen and gives off carbon dioxide. It grows, it reproduces, it moves about and it reacts violently to unpleasant stimulation. All forms of life have the one similar evolutionary characteristic of changing their size or form to conform to conditions under which they find themselves living.

We are dealing with life today, not in its simplified form, but as a composite grouping of cells to form organisms. These organisms group themselves in time to form the highly complex individual which we know as a human being. Life is comparatively simple for a one-cell creature like the ameba. The cell performs all the functions necessary to life, well-being and the propagation of the species. With the human being, it is not so simple. He has become a highly specialized creature with each organ more or less dependent on the others if the entire unit is to function as Nature would have it. As far as we know, none of the organs of the human body has the power of regeneration. When it is once injured or normal development is arrested, normal function is impaired or lost entirely.

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A salamander can still regenerate its tail or legs; a crawfish can develop a new claw; but, when a child loses his deciduous teeth and the permanent ones erupt, the cycle of growing teeth is for that individual completed. When Nature has erred in developing the human denture or forces over which we have no control have altered it to such a point that we recognize the condition as an abnormality, we call it malocclusion. The orthodontist is not only interested in correcting this deformity, but is also striving to study dental and oral development. As Dr. McCoy states in his book "Applied Orthodontia," orthodontia seeks to determine the factors which control growth processes to the end that a normal functional and anatomic relationship of these parts may be realized, and aims to determine what forces are necessary to maintain such conditions when once established.

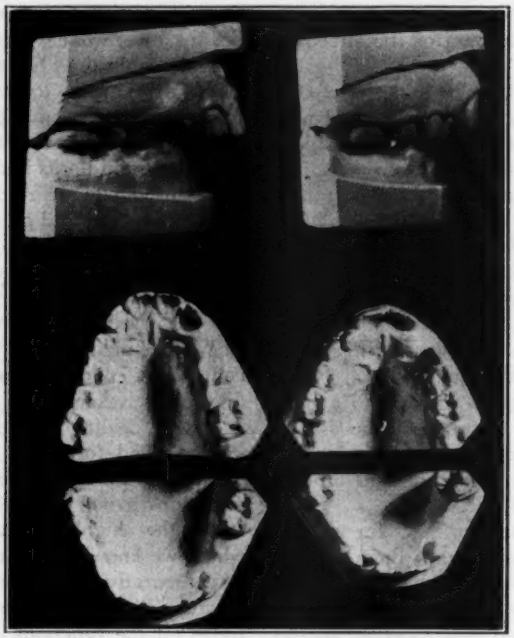

Fig. 1.—Two cases of same type at different ages in same family with similar case histories.

Investigations during the last century have uncovered evidence that primitive man did suffer from malocclusion. We presume it to be a fact that orthodontia had its inception when man first recognized a malocclusion and the desire to correct such an abnormality manifested itself. In tracing the evolution of orthodontia, we must first recognize science: philosophy, medicine and dentistry. Authentic records of the correlated sciences medicine and dentistry are found in Chinese literature of about 2700 B.C. One Chinese writer on medicine devoted two chapters to diseases of the mouth.

The first book on dentistry was supposedly one published in Germany in 1530. In 1686, Charles Allen published his dental work. John Hunter, in his book written in 1771-1778, devoted a few chapters to orthodontia. In the nineteenth century, we hear of Guilford

and Kingsley. The twentieth century brings to our attention men like Talbot, Angle, Jackson, Case and Farrar. While some of us may find little significance in the question as to who made dental history, we should be aware that each of the scores of individuals who earnestly recorded their observations and ideas in written form placed a stepping stone in the path of progress. We are still building on the foundation laid by these men. Modern orthodontics has come about through the transmission of knowledge from them. We are better able to cope with problems which confront us through a better education and human reason.

A case of malocclusion presents itself today. A consultation and observations will only bring us to the realization that a problem lies ahead. No conclusion can be drawn until every available means of securing a diagnosis of existing causative factors has been exhausted. I have already assumed that we have definitely determined on our own method of procedure, whether or not malocclusion of the teeth is present. The only pattern that we have to work from is the conception in our mind as to how these teeth would appear if no abnormalities were present. The patient has characteristics common only to himself.

We may, for instance, observe a typical case with a history of a pathologic tonsil and adenoid condition, with attendant mouth breathing, protrusion of the teeth and chin recession. We may recognize these conditions as the causative factors and set upon a corrective procedure without any further attempt at research in etiology. The indirect causative factor or factors may be lost in the seeming magnitude of the history or because of the presence of enlarged or pathologic tonsils and adenoids and mouth breathing. If no other hidden mysteries confuse such a case, we still have not solved the problem at hand. If we assume that the patient has been breathing abnormally for the greater part of his life, we are taking quite a chance in assuming that, by merely correcting the malocclusion,

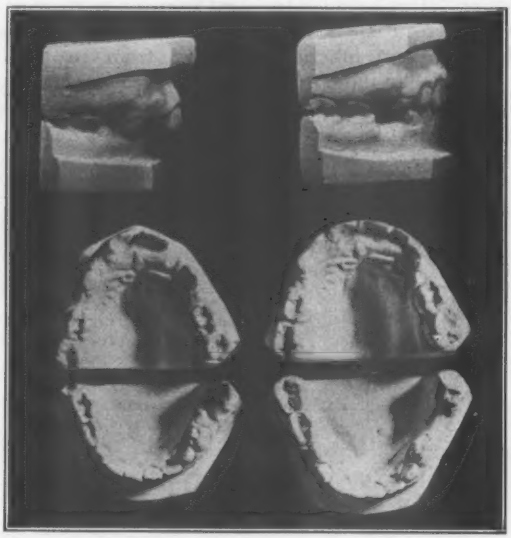

Fig. 2.—Case similar to types in Figure 1, showing correction to near normal.

all abnormalities of the mouth and its associated parts will disappear.

The etiologic evidence is very limited in spite of interesting suppositions and assumptions. Each year, contradictions concerning the etiology appear in the literature and in our observations. Howard, in his paper on inherent growth and its influence on malocclusion, stated that 159 of 500 tonsil and adenoid cases occurred in mouth breathers. In ninety-four, the jaws, arches and occlusion were normal.

Parents, on bringing the child to the office for examination, often attempt to explain some existing irregularities with the phrase that the condition is inherited from one of the parents. We should not dismiss the subject too lightly, since examination of the parents may reveal certain hereditary influences. If the definite malformation is not inherent, it may be that, in the development of the mouth, inherent tendencies have offset normal developmental forces.

Growth and development of the facial bones are variable. So is growth variable in the other structural parts of the body. Each case presents a growth problem. We perhaps like to think of a child as showing continuous and unfailing growth from the time of fertilization of the ovum to absolute maturity. However, we have all observed growth spurts and more or less temporary retardation of growth. Growth is intermittent in human beings as it is in plants. We do know that, in a family of several children all having the same environment, growth periods are variable with each individual. We likewise know that growth periods are extremely variable in children of the same age in different families.

C. C. Howard has charted a schematic representation of growth spurts and inhibition or temporary retardation. Dividing the entire growth of an individual up to adulthood or 21 years of age, he has named five periods of development, three of which are termed growth spurts, the two others inhibition periods. The three growth spurts are from fertilization of the ovum to birth, from birth to 7 years and from 11 to 16 years of age; the two temporary retardation periods, from 7 to 11 and from 16 to 21 years. These growth cycles, which are more or less commonly recognized today, are verified by the ossification center in the hand and wrist bones. However, after 7 years of age, it is necessary, for greater accuracy, to study the long bones of the body. To determine the normal ossification centers of these bones, it is necessary to know only the normal developmental period of the various centers.

Fig. 3.—Mesioclusion types at different ages.

Mention of the growth cycles is not made in order to convey the idea that orthodontic service shall be rendered only during the so-called growth spurts, but in order that it may be a guide to limiting somewhat the seemingly indefinite period of wearing orthodontic appliances when so little growth is taking place. There are cases needing orthodontic attention even during a period of stasis. We cannot sit idly by and allow specific impairment of function to continue when

some treatment is imperative. Such a period of treatment may be considered primary, and to be followed two or three years later by a secondary period, in order to assure the result desired.

Orthodontic service cannot be rendered and compensation be received on the same basis as for mechanical work in the mouth. Our work is not cut and dried and can seldom be measured as to any definite time for completion. The public must be informed of the nature of our problem if we expect their cooperation. Surgeons of the medical profession have found it to the patient's advantage and their own if they cooperate with Nature in determining certain centers of ossification of the nasal region before performing septum operations or other rebuilding of certain structures of the nose. In orthopedic surgery, deformities of the legs and feet are corrected at various stages of the child's development in order to complete the work as growth progresses. It seems that orthodontic service can be put on a similar basis. There are specific things to be done at specific periods, which are variable as to extent and time.

Food and diet are factors in growth control. Food should not only be of a certain quality or contain a full measure of the necessary elements, but should also be of such form as to require energy for its mastication. L. M. Waugh has said:

> Not only do I think and watch metabolism, in other words the chemistry of diet, but what I do watch more and more every year is the mechanics of diet. I have had the privilege of studying primitive peoples for a number of years and I have found that these people, living in their nomadic bands, subsisting on native foods frozen much of the year, dried meats such as walrus, seal, whale, caribou, wild fowl and fish, where they have little fuel with which to cook food, have strong teeth. The children chew almost from the beginning of life and I believe that these small people with these largest strongest jaws and best teeth, have developed them largely because of the mechanical stimulation of the food they eat. It is the mechanical side of diet that interests me quite as much today from the standpoint of jaw development as does the chemistry of nutrition. I have found that when those people get our soft foods that do not need chewing, even in one generation—I have casts to show them—the jaws become sufficiently smaller that the arches are crowded and the teeth become irregular.

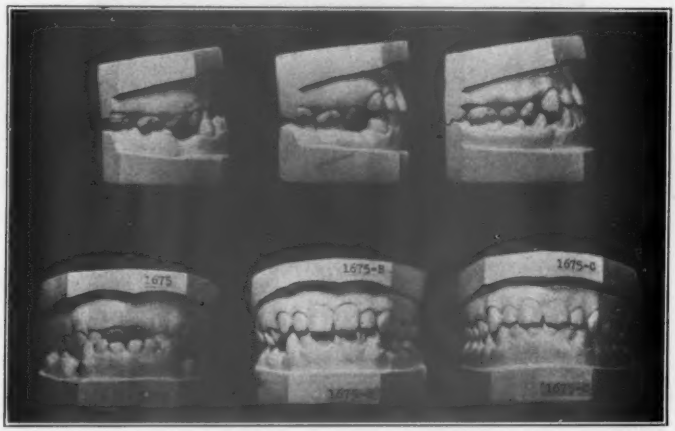

Fig. 4.—Casts of same mouth at different stages of growth.

Not infrequently, disturbances that

seem contrary to the effect expected from the appliances are due to the shifting of anchorage teeth or to minor habits that have developed. Many times, the prescribed use of intermaxillary force is not being observed. Such interruptions in the work can generally be overcome by our own efforts plus the patient's cooperation. Sometimes, more serious disturbances occur during treatment, or they may have been present to a degree before treatment began. I refer to endocrine glandular imbalance or dysfunction. Until a few years ago, little was said, or perhaps known, regarding the endocrine system. A critical analysis of over-

Fig. 5.—Case before and six years after correction.

growth and undergrowth in the human being has made the importance of the subject more or less generally accepted.

The endocrine system is a series of ductless glands functioning in unison or independently, controlling growth and the general metabolism of the body. These glands secrete hormones which are of chemical composition, each hormone having a specific function. Specific hormones are of like composition wherever found. This explains the fact that certain specific hormones can be obtained from animals and administered to human beings.

The pineal, pituitary, thyroid, parathyroid, thymus, suprarenal and sex glands all function in the normal development of the individual. The anterior lobe of the pituitary and the thyroid glands are generally more or less responsible for extreme variations in the size, differentiation and maturity of tissue. The growth factor is present in these glands, but usually is under regulation. When the normal growth or body regulation gets out of control owing to glandular imbalance or disease of the gland itself, grotesque appearances result if the disease continues unchecked. In fact, the normal development and function of the body are dependent on the development and function of its integral parts, and any variations from normal may change structurally and functionally the entire body organism.

Why the general metabolism is being disturbed is sometimes beyond our comprehension. We are not aware of severe metabolic disturbances until the damage is very evident and beyond repair. Modern medicine can detect endocrine imbalance and prescribe corrective therapy, but not until considerable damage has been done to the local mouth structure, with which we are dealing. Metabolism

tests are not given in routine physical checkups, and sometimes the patient is reluctant to have them. It may even be difficult to get the cooperation of the pediatrician or physician in charge, especially if the child has been under routine periodic examination. However, such instances are more or less rare, and we find the medical profession willing to fully meet our requests.

It is not the intent to enumerate here all the known causes of malocclusion. We should be alert enough in our daily routine to recognize that the etiology of a disease is not determined by an immediate cause. We do recognize a factor perceptibly important enough that its presence contributes to a certain result.

A few years of study and practice in a specialized field, such as orthodontia, gives one a better conception of the normal. The reference to normal occlusion, for instance, implies an esthetic, functional, physiologic mechanism within the limits of the type with which we are dealing. The treatment is to be based on our best judgment in the so-called borderline cases. We must treat when therapy is indicated, even if at intervals of a year or of several years, and exercise judgment in ceasing treatment when we have accomplished all that is within our appreciation of the normal for the age or for the type with which we are dealing.

In dealing with a biologic problem, we cannot blame biologic concepts for our failures or our limitations in delivering professional service. The success of treatment of the case may depend on the cooperation of the patient, potentialities of heredity, physiologic disturbances or our ability to handle the situation at hand. We should not be called upon to do the impossible, but we must extend ourselves to do all within our capabilities toward restoring to normalcy the case with which we are entrusted.

Treatment of conditions with hidden causes is being given by most of us. When we are called on to prescribe for a condition of unknown cause, we do what the physician does when he is called in on a baffling case in which one of several diseases may be suspected from the known symptoms; careful scrutiny of the case at hand, the elimination of some of the possible causes and failure of the prescribed forms of treatment finally pointing to a practical procedure for obtaining a satisfactory result.

Treatment may consist of muscle training, the correction of nutritional or

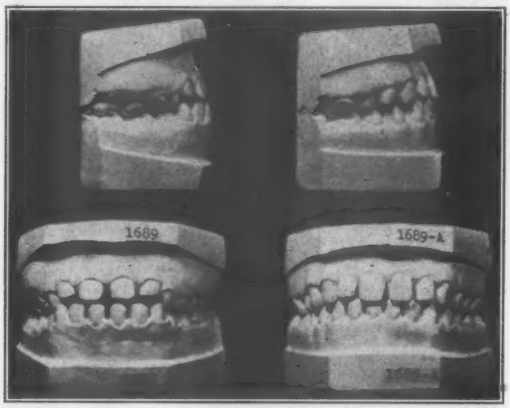

Fig. 6.—Patient at 7½ and 15 years of age; showing effects of tongue involvement.

glandular deficiency or, commonly, the use of mechanical appliances. Sometimes, we like to demonstrate what we can do with mechanical apparatus. Most of us today are, or should be, familiar with all the biologic and physiologic laws which control tissue quality and form; yet we find ourselves trying to force Nature to do what she is not ready and willing to do. Or, by the time she is ready and willing, our appliances are inadequate to perform the functions demanded. It seems that we all need a damper on our ambition to operate orthodontia appliances. It should be remembered that mechanical apparatus is but one aid in correcting malformation and it cannot be depended to do the whole job.

The orthodontia problem cannot be solved by a laboratory or factory turning out orthodontic appliances, regardless of how well made or under whose patented trade name, or if exploited under the guise of some pet system. Laboratories and factories have a definite service to perform and their work should be confined to manufacturing and should not include diagnosis or treatment.

We cannot overemphasize the value of esthetics in appliances employed for treatment. I cannot conceive of anything more discouraging to a prospective patient than seeing a patient wearing ill-fitting appliances. With careful technic and manipulation of the highly developed metals furnished us today, there is no reason for employing appliances that resemble a barbed-wire entanglement in no man's land. If orthodontia has a place in the sun as one of the most important specialties of dentistry today, why not keep it there by being masters of fine technic and students of esthetics and by becoming more meticulous in our office routine?

Too many cases come to us in advanced stages of malocclusion. It is unfortunate that some of these cases were not seen earlier, for consultation if not

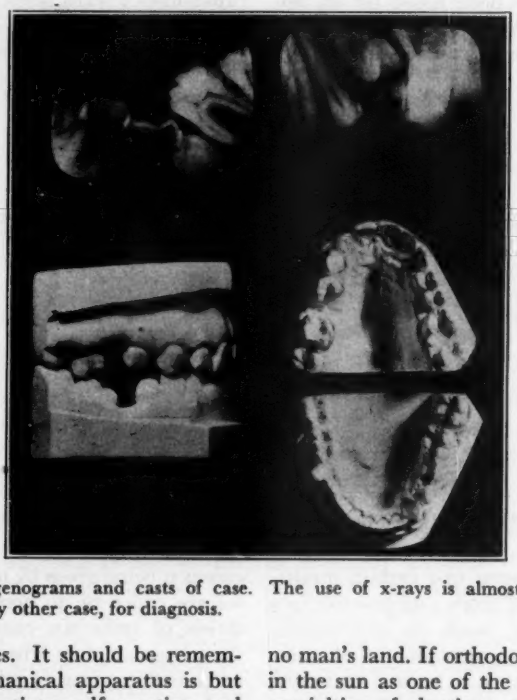

Fig. 7.—Roentgenograms and casts of case. The use of x-rays is almost indispensable in this as well as every other case, for diagnosis.

treatment. Results are more predictable and treatment is simplified if a case has been under observation, or perhaps, at short intervals, treatment has been administered previous to or during the permanent dentition. Too many cases are presented with a history that "we noticed that his teeth did not look right, but we were advised not to do anything or have anything done until all the permanent teeth were in place." Perhaps "a neighbor" told the parent that such conditions "straighten out later on." Snap judgment in diagnosis is always to be avoided. All cases are not amenable to treatment; but there are few cases in which treatment cannot be of some help. A friendly consultation with a fellow practitioner is always in order. Cooperation will increase our wisdom and our capacity for service to our patients.

The complicated organism upon which we are working is constantly subject to change, and our work is not comparable to work upon a mechanism of steel and fabrics the consistency of which is known, tested and tried. The public has become quite tolerant of the limitations of service of modern means of transportation and domestic appliances. They should not be led to expect the impossible in the care and preservation of from twenty-eight to thirty-two living organisms in the mouth which are under varying stresses and forces over which we have little or no control. Our plea for tolerance on the part of the public can be answered by education. Those who are practicing general dentistry can be of service by telling the parents of prospective patients something of the nature of the orthodontic problem before they are referred to the orthodontist.

If one does not feel qualified to pass judgment as to whether a mouth needs immediate attention, he should refer the case to some one who can do so. Professional etiquet and our obligation to the patient come first. To offer timely suggestions to patients who are in need of orthodontic service is imperative. The profession is progressing today and will continue to do so with our help. Better trained students will continue up the road of progress. The road can be made smoother and the progress faster if we do our part to help educate and keep informed a public that is more susceptible to dissemination of knowledge concerning dentistry and general health today than ever before. Continued improvements in teaching and research will have a favorable reaction, with the result that all participants will benefit.

I am presenting a few routine cases selected from practice which bring out the more important features of my paper.

Figure 1 shows a brother and sister; a girl, aged 10, and a boy, aged 7. Both have had their tonsils and adenoids removed. Both gave a history of mouth breathing from infancy. This type of case should, I believe, be corrected as nearly as possible at an early age and carried on later, with a secondary period of treatment at 10 or 11 years of age and a third period later on if necessary. These cases demonstrate the necessity for early correction for coordination of all the muscles which enter into a normal respiratory and masticatory development.

Figure 2 shows the case of a boy, aged 7, with the same factors as were present in the boy's case in Figure 1, involved in creating the distoclusion type case. The cast on the right shows the same case twenty months later, after slightly more than a year of orthodontic treatment. Correction of the overbite and the improvement in the mesiodistal relationship are evident. It is readily seen that the chance for development in the respiratory and masticatory apparatus has been greatly improved. However, this case should be under periodic observation throughout the eruption of the permanent teeth.

Figure 3 shows three mesioclusion cases in children aged 6, 10 and 13. There may be hereditary as well as

glandular involvements in these cases, and the procedure in such cases should always be based upon considerable experience in dealing with these types.

Figure 4 shows three casts of the same case at different ages. It is not a true mesioclusion or Class III, Angle classification. The molars are in a normal mesiodistal relationship, while the anterior teeth in the first cast to the left are in lingual occlusion. The causative factor in this case appeared to be an excessive tongue development. The spacing in the premolar and cuspid region in the mandible is to be noted. The active orthodontia service covered a period of approximately two years. The cast in the center shows the case at 12½, five years after beginning treatment and three years after active treatment was discontinued. The cast on the extreme right shows the same case at 15½ years, six years after the orthodontic work had been completed. The greater spacing in the lower premolar and cuspid region is evident. The overbite is becoming a little less evident. In fact, there is an almost end-to-end combat of the lateral incisors.

Figure 5 appears to be a mesioclusion case, but the irregularity is confined to the anterior part of the mouth since the molars are in normal relationship. The causative factor appears to be premature loss of the deciduous cuspids. The patient was 7½ years old. The case was treated for nearly two years. The family was lost sight of. One day, the patient, a girl, came in with a friend who was having orthodontic work done. She was then 15 years old. Impressions were taken of the case (right). The permanent dentition was nearly perfect approximately six years after the orthodontic appliances had been removed. This is another instance wherein early treatment was indicated.

Figure 6 shows the case of a girl, aged 7½ years, with an overdeveloped tongue. Whether the tongue is forced anteriorly between the teeth for want of room or whether placing the tongue is this position is a habit developed from infancy it is difficult to say. The mother mentioned that as a baby this girl seemed to have too much tongue. At 7½ years, treatment was begun. Surgical removal of the tongue muscle was not attempted in this case. The cast on the right shows the same case at 15 years of age. There has been no treatment for the last four years. The anterior teeth show a slight overbite and some spacing, although a better result than one might expect with the prevailing causative factors.

Roentgenograms are indispensable. They should be made for every case before and during treatment, if possible. The case shown in Figure 7 was not roentgenographed previous to the placement of appliances and had been under orthodontic treatment for a year just a few months previous to the taking of these roentgenograms and casts. The case history revealed that space was provided for what was thought to be upper and lower second bicuspids on the right side. The teeth, supposedly the bicuspids, could be seen pointing through the gum tissue. The operator and patient waited in vain for these teeth to erupt.

When the case came to my attention, roentgenograms were suggested. The crowns of both deciduous molars were submerged, and the permanent teeth submerged still deeper. The patient is 13 years old. Roentgenograms and institution of a proper procedure two years ago would have obviated treatment.

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THE FLAP OPERATION AND ITS PLACE IN THE TREATMENT OF PERIODONTAL LESIONS

By ROBERT L. DEMENT, D.D.S., Atlanta, Ga.

PERIODONTOCLASIA is not a modern disease, or condition. It has, according to history, existed since about the thirty-seventh century before Christ. In the early writings, it was referred to as "bleeding gums," "hemorrhage of the gums," "shaking teeth," etc. It was found to be most prevalent among the more civilized people.

In the early centuries, there were many hypotheses as to its etiology and treatment, but not until 1867, when John M. Riggs, of Hartford, Conn., gave the first successful treatment to the profession, did we have anything with which to successfully combat the disease, which was then referred to as "scurvy of the gums." Riggs' treatment, according to men associated with him, consisted of thorough subgingival curettage, cleaning and polishing, with instructions to the patients in the care of their mouths at home.

Since the time of Riggs, and especially in recent years, much research work has been done in the field of periodontology, and, as a result, the masticating mechanism is being preserved for a much longer period.

Many theories have been advanced as to the correct procedure in the treatment of all types of periodontoclasia, all theories seemingly based on sound conclusions as to the etiology. Some of these theories have proved to be sound stepping stones on the road to success, while others, like cataphoresis, emetin hydrochloride, vaccine therapy, etc., have been cast aside as failures.

In the treatment of suppurative periodontoclasia, or what Stillman and McCall, in "Clinical Periodontoclasia," refer to as "pericementoclasia," there are four favored technics in use at this time: subgingival curettage, or what is usually referred to as the conservative procedure; the flap operation, full and modified; gingivectomy, and electrocoagulation. Much depends on the skill of the operator and the particular case in hand, as to what procedure should be followed. While one person will be successful with one technic, another will be able to obtain very satisfactory results with another. After all, the successful end-result is the thing striven for by all.

I employ subgingival curettage, the flap operation or gingivectomy, which-

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ever I feel is indicated, always leaning toward the more conservative procedure. The remainder of this paper will be confined to the flap operation.

There is a question as to who originated the flap operation. Some give Widman the credit. Others assert that Robert Neuman, of Berlin, should be recognized as the originator. Neuman claimed to have first used the flap operation in the treatment of so-called pyorrhea alveolaris as early as 1912, but he did not present this work to the profession until 1914. Following Neuman were such outstanding men as Nodine, Zemsky, Berger and others. Arthur Zentler, of New York, was the first to perform this operation in the United States, early in 1918. Olin Kirkland, of Montgomery, Ala., on witnessing one of Zintler's operations, recognized it to be a fundamentally sound procedure, although rather radical in some cases in that it caused unnecessary discomfort. He returned to his office and worked out a modification, presenting it to the profession the latter part of 1918.

This paper will deal not only with the full flap operation, but also the modification, the technic which is being used so widely today.

INDICATIONS

It is a well-known fact, not only in the treatment of periodontoclasia, but also in all other conditions, that age, general health and habits of living have a great bearing on the biologic response of the tissues to treatment, as well as in the prevention of a disease process, or in maintaining healthy tissues.

In young, healthy individuals, the response to surgical treatment has been more rapid and satisfactory than in those more advanced in years, especially when the health of the patient was below normal.

The teeth, with their supporting structures, are shaped in such a manner as to afford the maximum satisfaction in appearance, self-cleanliness and efficiency, as well as self-protection. When the normal contour of these tissues is altered, there is danger of trouble, since the tissues are less self-protecting, and the tissue contours are no longer normal. In the treatment of periodontoclasia, we should strive to maintain the normal contour as nearly as possible by conserving tissue.

In deep lesions, where there is some doubt as to whether subgingival curettage can permanently relieve the pathologic condition, the flap operation is very satisfactory, since it conserves the overlying gingivae and, with the blood clot acting as a scaffolding, there may be a regeneration of the process. Of course, complete regeneration will not take place, but there will be enough to add strength to the tooth, or teeth, and to restore, more or less, the normal contour of the tissues. In the maintenance of normal contour, the end-results are much more pleasing, from the standpoint of esthetics, and it is much easier for the patient to keep the periodontal tissues clean. Another point in favor of the flap operation is the fact that healing is much more rapid than in complete removal of the gingival tissue.

In the anterior part of the mouth, and especially if there is a high lip line, the flap operation is the procedure of choice. With the posterior teeth, it is also a good procedure, but slightly more difficult, especially if there is an involvement of the bifurcation or trifurcation. I always prefer the modified flap operation, since it causes less trauma and there are not so much postoperative soreness and swelling. However, I do not hesitate to use the full flap operation in deep isolated areas, if necessary.

It is a well-known fact that the horizontal, or simplex, type of lesion is much more amenable to treatment than the vertical, or complex, type, since the etiologic factors are not so difficult to eliminate. Subgingival curettage may be used

effectively in this condition, as well as gingivectomy, although in the latter there is no attempt to conserve the gingival tissue. The flap operation may be used in both types with good results.

It has been my experience, in operating upon vertical, or complex, lesions, using the gingivectomy technic, that if the apex of the lesion is not made more or less horizontal, there is some question as to proper healing. In changing the shape of the lesions, it is so often necessary to remove the process to the extent that the support of the adjacent tooth is weakened. With the flap operation, this process is permitted to remain, and it aids materially in the regeneration of the destroyed tissue. If there is a cupping-out of the interproximal area, leaving a plate of process, bucally, labially and lingually, it is unnecessary, in fact inadvisable, to remove this tissue, since it will act as a matrix in the restoration of the lost process.

THE FULL FLAP OPERATION

The full-flap operation consists of two incisions parallel to the long axis of the teeth, starting at the gingival border in the interproximal spaces, and extending apically to the region of the apex. Another incision is made in the interproximal area, mesiodistally, separating the buccal or labial gingiva from the lingual. With a periosteal elevator, the flaps are drawn back, and the field of operation is exposed. With tissue retractors, or forks, the tissue is held back and, with suitable curets, the pathologic tissue, hard and soft, and calculus are removed and the process is smoothed. The flaps are coaptated and sutured. The wound is dressed with iodoform gauze, small strips being packed in the interproximal spaces and a larger strip placed over the entire wound. The patient endeavors to keep this dressing in place for about twenty-four hours. The sutures are removed in three or four days.

THE MODIFIED FLAP OPERATION

Whereas in the full-flap operation, there are three incisions, two laterally and one in the interproximal tissue, the modified flap operation necessitates only one. The incision is made mesiodistally in the interproximal mucoperiosteum, and as near the center, buccolingually or labiolingually, as possible. Of course, for this part of the operation, a very small, slender knife is used. With the periosteal elevator, the flaps are carried back, buccally or labially, and lingually, about 2 mm. beyond the border of the healthy process. This enables the operator to thoroughly visualize the field of operation and gives sufficient room for free movement of the instruments. The flaps are drawn back with tissue retractors; the pathologic granulation tissue is removed with suitable curets, and the remaining portion is trimmed away with small shears or nippers. The field is then washed out with a warm physiologic sodium chloride solution and sponged dry. The field of operation is now thoroughly visible and the exposed roots and diseased bone may be completely curetted.

It is advisable to operate on not more than a quarter of the mouth at any single sitting and to allow two or three days, or more, to elapse between operations.

As perfect hemostasis is much to be desired in operating, it is sometimes necessary, or at least desirable, to have an aspirator in addition to the sponges, in order to keep the field of operation dry and free, as nearly as possible, of blood and saliva.

For final inspection, the wounds are thoroughly sprayed with physiologic sodium chloride solution and thoroughly dried. Any deposits on the teeth or fragments of pathologic tissue remaining are removed completely. The parts are sprayed again, just before the wound is closed, with surgical solution of chlorinated soda (Dakin's). The flaps are then coaptated and sutured with oooo fine

dermal suture material. One suture is required for each interproximal space. If the technic has been carefully followed, the sutures should be the only evidence of an operation in many of these cases.

In order to stimulate the tissues surrounding the field of operation and encourage a good blood clot to form under the flap, hot packs are placed over the area and allowed to remain until cool. It is sometimes advisable to apply packs two or three times. These packs are prepared by rolling ordinary absorbent cotton or cutting to proper length large cotton rolls. These are placed in the sterilizer or hot sterile water and then placed in a sterile towel, so that a portion of the water may be expelled, but not enough to allow the pack to cool too rapidly as it is applied to the field of operation. Before the packs are placed over the wound, they are allowed to cool sufficiently to avoid blistering the mucous surface.

After the teeth and gums have been thoroughly dried, a sterile wax dressing, consisting of twenty-five parts English resin and seventy-five parts pink baseplate wax, is melted in a metal container, such as a dissolving cup, over a Bunsen burner, and painted over the area with a camel's-hair brush. The dressing should be allowed to flow thoroughly between the teeth.

The dressing may be removed about the third day and the sutures may remain from four to six days. The patient is, of course, warned not to chew on or brush this area during this time.

After the sutures are removed, the patient is instructed to use the Charters' method of brushing and to employ dental tape. For the first five or six weeks, the brushing should be done very lightly, but sufficiently for thorough stimulation and cleansing. Exerting too much force with the brush at first will cause a dissipation of the blood clot before organization takes place, thus eliminating the possibility of bone regeneration. The tape should also be used very carefully to avoid breaking down any reattachment which might take place.

After healing takes place, the teeth are thoroughly polished, especially around the cervical portion. The patient is then instructed to return at regular intervals for prophylactic treatment and checking of the occlusal relationship. The frequency with which the patient should return is governed by the thoroughness of the home care. It is a well-known fact that some people can, and will, carry out the instructions as to home care much more thoroughly than others. With some, every three to six months is all that is necessary. With others, a light prophylactic treatment every month would not be too much, but is indeed necessary to maintain the health of the gingival tissues.

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PROBLEM OF ELECTROGALVANISM IN THE ORAL CAVITY CAUSED BY DISSIMILAR DENTAL METALS

By EVERETT S. LAIN, M.D., Oklahoma City, Okla.; WILLIAM SCHRIEVER, Ph.D., Norman, Okla., and G. SHERRILL CAUGHRON, D.D.S., Oklahoma City, Okla.

ON several occasions, one of us[1] (E. S. L.) alone or in association with others has discussed lesions or injuries of the oral cavity tissues which apparently were caused by electrogalvanism between electrically dissimilar dental restorations. A review of medical and dental literature reveals that since his presentation of this subject to the American Medical Association in June 1931, which cited thirty case reports, and the almost simultaneous reports of three cases by Lippmann,[2] much interest in this phenomenon has been aroused among physicians and dentists throughout America and Europe. The results of much additional laboratory research and many more case reports have been published in various dental and medical journals.

There now appears to be unanimous agreement upon approximately all the fundamental factors of this phenomenon, which were enumerated in our first publication. 1. Human saliva does constitute a good electrolyte. 2. In every oral cavity containing dissimilar dental metals, there exist all the elements for galvanic cells. 3. Certain symptoms and pathologic lesions in the mouth diagnosed as electrogalvanic lesions disappear after complete and correct replacement with certain metals.

During the past eight years, we have received several hundred additional case reports of what is apparently oral cavity electrolysis. In addition, almost all of the textbooks on metallurgic dentistry and diseases of the mouth and skin published since 1932 have included paragraphs or entire chapters describing this pathologic phenomenon. Other writers[3] have fully acknowledged the clinical evidence of electrogalvanic injuries in the oral cavity, but they deny the existence of continuous electric currents. Therefore, it appears that the principal questions for discussion here are: 1. What are the important sources of electromotive force in a mouth containing dissimilar dental metals? 2. Through what tissues, fluids and structures of the oral cavity do the electric currents pass? 3. Is there experimental evidence that dental metals are transported through the tissues and fluids in accordance with the laws of electrolysis?

Before describing our recent work and giving our interpretation of the electrical and spectroscopic data, we shall enumerate the symptoms of galvanic action in the oral cavity, dividing these into subjective and objective symptoms and then naming some contributing factors.

SUBJECTIVE SYMPTOMS

The common subjective symptoms of electrochemical changes in the mouth are:

1. A metallic taste usually appearing immediately after the restorations are made. After a time, this taste may disappear or at least cause no discomfort.
2. An increase in salivary secretion.

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3. A burning or tingling sensation in the mouth, usually intermittent and occurring first upon the margins of the tongue, although evident elsewhere.

4. Occasional nerve shock and pulp sensitivity, especially when opposing dissimilar restorations come in contact, or when temporary connections between such restorations are made by a spoon or fork.

5. General discomfort in the mouth; also irritability, indigestion or loss of weight.

6. Reflex radiating neuralgic pains through branches of the fifth (trigeminal) nerve. During the course of our clinical studies, one of us (G. S. C.) has been particularly interested in the possibility of reflex sensory nerve disturbance

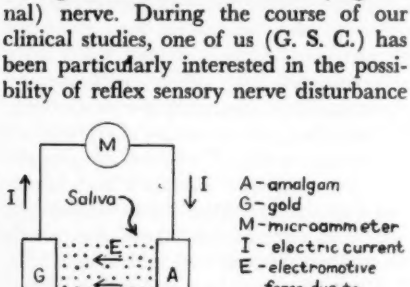

Figure 1

Restorations in Saliva only.
Electric current flows as indicated.

arising from oral electrolysis. Several patients with positive erosions or ulcers of the buccal and lingual mucosa had also suffered from a more or less constant neuralgic pain radiating from the area of the lesions through the sympathetic branches of the trigeminal nerve. In some cases, the patients complained of a slightly itchy, stinging, puckery sensation, especially at the trigeminal nerve endings upon the lip mucosa. This may be explained upon the basis of the law of referred pain.

However, it is known that the trigeminal or fifth nerve has both motor and sensory functions and that it has branches which supply the various soft and hard structures of the oral cavity. Therefore, it is not wholly speculative to assume that some cases of persistent radiating neuralgia may be ascribed to oral cavity galvanism. This is borne out by the fact that after the establishment of a homogeneity of dental restorations, in each case, not only did the mucous lesions promptly heal without other treatment, but also the neuralgic pains slowly subsided and did not recur.

OBJECTIVE SYMPTOMS

The various objective symptoms are:

1. Disintegration and discoloration of metallic restorations. The electropositive metals give evidence of erosion by their clean appearance. In electronegative restorations of gold and platinum and those with a high percentage of silver,

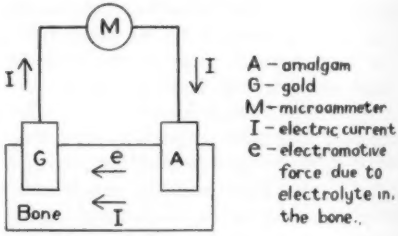

Figure 2

No Saliva Present
Electric current flows as indicated

there is often a darkened, tarnished color as the result of deposits of products formed from the positive metals such as aluminum, zinc, tin, nickel and copper.

2. Decomposition. Dental cement, which contains a high percentage of zinc, is also strongly electropositive to the noble metals. Therefore, when the cement is exposed to the saliva, rapid decomposition occurs, which may permit a loosening or a falling out of both silver and gold fillings.

3. Erythema and blanching of the mucosa, and other evidence of chronic irritation.

4. Prominence and sensitivity of both anterior and posterior groups of the papillary bodies (lingual tonsils) upon

the dorsal and posterior margins of the tongue.

5. Erosion and ulceration of the buccal mucosa, with denuded patches and geographic areas upon the dorsal and marginal areas of the tongue. All of these symptoms may be periodic and may be influenced by a change in diet. Electrogalvanic lesions upon the mucosa or tongue most frequently occur adjacent to or near the positive metal. They rarely appear before several months and sometimes only after many years of galvanic irritation.

6. Leukoplakia; a grayish, horny, elevated, precancerous lesion which usually occurs after long continued chronic irritation.

7. Pathologic changes (rarely) in the blood and in the kidneys or other organs, as found by Lippmann,[3] probably caused by absorption of toxic metals.

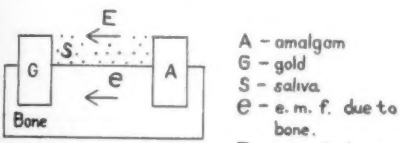

Figure 3

Restorations flooded with saliva. The electromotive forces exist. Do electric currents flow?

CONTRIBUTING FACTORS

Both the visible lesions and the subjective symptoms of electrogalvanism in the mouth have a number of contributing factors: 1. The dental alloys used in the restorations. 2. The physical condition of the patient. 3. The sensitivity of the patient to galvanism, especially his sensitivity to certain metals when they are absorbed. 4. A lowered general tissue resistance caused by anemia, avitaminosis or certain habitual excesses.

Additional evidence that galvanic currents exist in the structure of the oral cavity was obtained during the latter months of 1935. Biopsies were made on buccal, gingival and lingual tissues adjacent to the electropositive and electronegative metals in cases of suspected oral cavity electrolysis. Spectroanalyses of these tissues revealed almost uniformly an excess of calcium, magnesium, silicon, tin and, in a few cases, copper, near the electropositive metals. Only sulfides and organic matter were found near the electronegative, or noble, metals. We have since made an additional spectroanalysis in which was found approximately the same interchange of metals. It is gratifying to know that Eijiro Wakai, M.D.,[4] of the University Medical College of Tokyo, Japan, early in 1936, by electrolysis *in vitro* and in the human mouth with saliva, found approximately the same interchange of metals and arrived at similar conclusions.

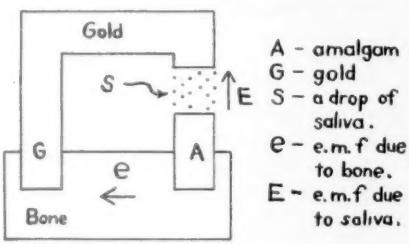

Figure 4

The two electromotive forces oppose each other; if they are not equal an electric current will flow in the direction of the stronger.

Other evidences of electrogalvanism in living bones and tissues have been presented by Venable, Stuck and Beach.[5] In the fractured radii of dogs, they placed screws made of various pure metals and alloys. Two screws were placed near each other in each radius. In some cases, the screws were of the same metal; in other cases, they were of different metals. They found that the screws were badly corroded after from four to six weeks and that the corrosion was much worse when the screws were of different metals widely

separated in the electromotive series. They also made chemical analyses of the tissues near the screws. Their work convinced them that galvanic action *did* occur and that the metals were transported as would be expected from their position in the electromotive series. Their report indicates that they made no attempt to determine the direction of the electric currents that must have existed. They kindly furnished us with several of their slides.

EXPERIMENTAL WORK

Animal experiments were begun in September 1938 with three dogs which

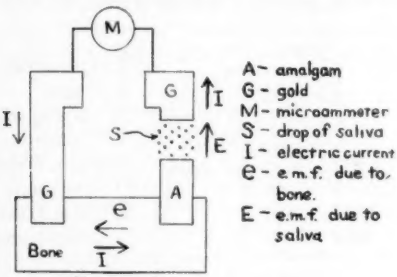

Figure 5

The microammeter showed that an electric current flowed in the direction indicated Therefore E is greater than e

we had kept in the laboratory for a period sufficient to determine their good health. They were kept in the same kennel and fed the same food (Purina), a specially prepared balanced food which has been used in our medical school kennels for several years.

Dog 1 was kept as a control, no metals being placed in its mouth.

In the mouth of Dog 2 were placed five silver amalgam fillings of approximately the following composition: silver, 60 per cent; tin, 29 per cent; copper, 3 per cent, and zinc, 1 per cent. Fleck's yellow cement was used.

In the mouth of Dog 3 were placed seven silver amalgam fillings, and three so-called copper amalgam. Three canines were crowned, respectively, with gold, alcolite and technic metal.

Microammeter readings were taken at the beginning and at completion of the operation. Readings tissue to tissue were zero. Readings in Dog 3, between radically dissimilar metals, were high—80 to 100 microamperes. Between similar amalgams in Dog 2, the readings were only 4 to 20 microamperes.

Examination and laboratory tests were made several times during a period of eighteen months, after which Dog 3 was killed. Before the animal was killed, several microammeter and potentiometer readings were made by repolishing the metals and puncturing the tongue and

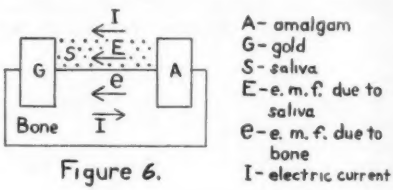

Figure 6.

Directions of electromotive forces and electric currents when the restorations are flooded with saliva.

maxillae immediately between, avoiding contact with the metals. In each case, if the tissues were not too dry, readings of from 2 to 4 microamperes were noted, with approximately a four times greater intensity by potentiometer.

A similar experiment was then performed upon a section of tongue and tenderloin of a freshly slaughtered beef, after the piece of tissue had been half immersed in artificial saliva pH 5.8. There was an initial reading of 80 microamperes between a small piece of 24-carat gold and 60 per cent silver alloy. Connecting cords tipped with 24-carat gold were then inserted in the piece of tenderloin directly between the metals. As was to be expected, the meter was reversed and registered 2 to 4 microamperes, which held for a period of several

minutes. After removal of the metals from the piece of tissue, the readings were nil.

During these laboratory experiments, we made several interesting observations:

1. The secretion of saliva of dogs under a general anesthetic is very much diminished. This fact somewhat hampers such mouth experiments.

2. Contrary to common opinion, the pH of the saliva in twenty-five laboratory dogs tested measured 7.6 to 8.5, being strongly alkaline.

3. True to nature's laws of inherent protective physiologic functions in the animal, after several months in all metallic restorations there was a heavy coat of tartar, calcium and other inorganic and organic matter, which provided external insulation against any injurious effects of the galvanic current.

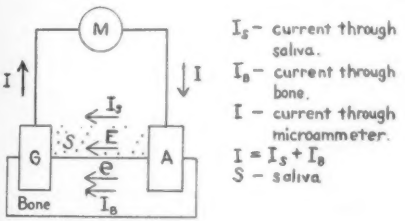

Figure 7.

Direction of a current when a low-resistance microammeter is connected to the two restorations that are flooded with saliva

The evidence presented thus far, favoring the view that electric currents actually flow in the bones and tissues of the mouth, is certainly circumstantial rather than direct. That galvanic potential differences must exist between prostheses made of different metals was shown years ago by one of us (E. S. L.) when he reported measuring electric currents between prostheses with a microammeter. The question is, do any electric currents exist when the microammeter is not connected and when the metals do not touch each other?

Reports of recent investigation indicate that the evidence of the existence of electric currents between dissimilar metals in the mouth is not entirely conclusive. Certain reasons have been advanced as to why such currents cannot flow or at least cannot continue to flow for any appreciable time. These reasons can be shown either to be based on incorrect information or to be contradicted by what appear to be equally good experimental data. Electrical experiments showing that currents do or do not exist have apparently not been reported.

LABORATORY EXPERIMENTS*

Figure 1 shows the results when gold and amalgam are immersed in saliva, which is an electrolyte. If the microammeter (M) were not connected with the two pieces of metal, small electric charges would move from the gold and amalgam to the saliva in such a way that a difference of potential (E) would exist between them, but no current would flow. This difference of potential could be measured with a potentiometer, without any flow of current, and would be called the electromotive force, or E.M.F., of the amalgam-saliva-gold cell. When the microammeter is connected as shown in the figure, an electric current (I) does flow around the circuit from the amalgam to the gold through the saliva, and from the gold to the amalgam through the microammeter. This result would be expected, since amalgam is electropositive to gold.

In the mouth of Dog 2, the gums and the teeth in the proximity of gold and amalgam were carefully freed from saliva, and the two fillings were thoroughly dried. When these were connected through a microammeter as shown in Figure 2, a current (I) flowed from the gold to the amalgam through the meter. This shows that the fluid in the bone, together with the two metals, formed an electric cell having an electromotive force (e) in the direction shown. This is

*By William Schriever.

exactly what one would expect since the fluid of the bone is an electrolyte and since the amalgam is electropositive to gold.

Figure 3 shows the results when two metals are flooded with saliva. From the two preceding experiments, it is seen that the two electromotive forces are in the direction amalgam-to-gold through the respective electrolytes. The question is, do these two electromotive forces cause an electric current? Obviously, it was not possible to insert a microammeter to measure the current, even if it existed. However, it was possible to make a satisfactory modification of the circuit that did have exactly the situation shown in Figure 3.

In Figure 4, the gold has been lengthened so that its free end is directly above the amalgam. All the saliva is removed except one drop connecting the ends of the metals. The amalgam-bone-gold electromotive force (e) tends to send the current clockwise around the circuit. It is to be observed that both electromotive forces are from amalgam to gold through the respective electrolytes, just as they were in the preceding figure; hence, these two circuits are equivalent. One would expect a current in Figure 4 to flow around the circuit in the direction of the greater electromotive force. It is now possible to insert a meter to measure this current and to determine its direction.

Figure 5 shows how a microammeter was connected between the two parts of the same gold filling after it was cut in two. The saliva was entirely removed and then one drop was placed between the movable piece of gold and the amalgam. An electric current (I) of more than a microampere flowed in the direction of the saliva electromotive force (E). This shows that the amalgam-saliva-gold electromotive force E is greater than the amalgam-bone-gold electromotive force e.

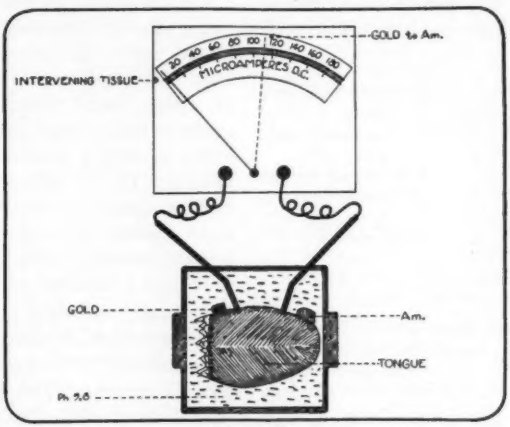

Figure 8.

A further test of the electromotive force was made by direct contact at the movable piece of gold to the amalgam. Since this contact removed the saliva E.M.F. from the circuit, only the bone E.M.F. e was active, and one would expect the flow of the current through the microammeter to be reversed. This is exactly what was observed. In fact, the current was more than doubled in strength, and this also would be expected if the saliva electromotive force were not more than a few times as great as the bone electromotive force.

Let us return to the condition in which the metals are flooded with saliva as

shown in Figure 6. We now know that the E.M.F. E of the saliva electric cell is greater than the E.M.F. e of the bone electric cell. In principle, the situation is exactly like connecting a 2-volt lead storage cell so as to oppose a 1½-volt dry cell. The circuit would flow in the direction of the 2-volt E.M.F. of the lead cell and would flow backward through the dry cell. Similarly, in the case of the restorations in Figure 6, we have now every reason to believe that a current (I) flows around the circuit in the direction of the larger E.M.F. E and against the E.M.F. e. We would expect such currents to be small for several reasons: (1) the electromotive forces are small, evidently only a few thousandths of a volt; (2) the current is caused by only the difference between two such small electromotive forces, and (3) the electrical resistance of the current paths in the bone, tissues and saliva is relatively high.

Next let us consider the directions of the currents through the bone and saliva when the two areas are connected by a microammeter, as shown in Figure 7. If the resistance of the meter is low as compared to that of the path through the saliva and that of the path through the bone, both the saliva cell and the bone cell will furnish current through the microammeter and these two currents (I_S and I_B) will flow in the directions of E and e respectively. The current through the microammeter (I) will be $I_S I_B$.

Since an ordinary microammeter has a relatively low resistance, the current through it, when it is connected to two metals, will be furnished by both the saliva cell and the bone cell. Hence, such currents are much larger than one would expect them to be through the same restorations when they are not metallicly connected, as through the meter, or when they touch each other directly.

It has been reported that the galvanic lesions on the tongue were caused by thermal burns, the heat evidently being generated by the electric currents that flow through the tongue. To test this, resistance measurements were made (December 1933) on fresh beef-bone and muscular tissue, and also in the mouths of human adults. From these experiments, it was concluded that bone offers a resistance about eight times greater than muscular tissue; normal tooth enamel about sixty times greater than maxillary bone, and buccal mucosa more than twice a like thickness of the tongue. The tongue offers less resistance than any of the structures of the oral cavity.

From these resistance determinations and the currents observed with the microammeter, the heat that would be generated by the current was calculated. Because the amount thus generated was so small, it was concluded that galvanic lesions due to metallic restorations cannot be caused by thermal burns.

The problem of determining all the possible sources of electromotive force in an oral cavity containing restorations has not been solved. However, the investigation has shown that at least two important electromotive forces exist; that the one due to the saliva is greater than the one due to the fluid in the bone, and that small electric currents do flow when restorations of two electrically dissimilar metals are present in the oral cavity.

A rather elaborate series of experiments has been planned in which it is hoped to measure the electromotive forces of the various possible types of electric cells in the oral cavity, the resistance of some of the current paths and some of the currents that result. By making quantitative measurements with suitable electrical apparatus and using some special restorations, it is hoped to determine whether the currents flow continuously.

SUMMARY AND CONCLUSIONS

1. From a further cooperative study of electrogalvanism between dissimilar dental metals, showing the results of labor-

atory experiments both *in vitro* and *in vivo*, there is clinical evidence that galvanic currents due to electrically dissimilar metallic restorations of the teeth do flow through the tissues of the mouth. The most convincing evidence is the complete disappearance of lesions and other symptoms of galvanism when the offending restorations are cautiously replaced, leaving all the metals in the mouth electrically homogeneous; i.e., the new restorations do not assume electrical differences of potential.

2. Spectroscopic analyses of tissues removed from the lesions near the electropositive restorations in many cases show an excess of the metals.

3. It is believed that this phenomenon can be explained by consideration of the galvanic electromotive forces and the resulting electrolysis.

4. Electrical experiments show that an electromotive force is generated by the electrolytic fluid in the bone acting on amalgam and gold; an electromotive force is generated by the electrolytic saliva acting on amalgam and gold; the directions of these electromotive forces are those that would be expected from the relative positions of these metals in the electromotive series, and the saliva electromotive force is greater than that due to the bone fluid. These experiments appear to demonstrate conclusively that electric currents do exist in the structures of the mouth when the mouth contains electrically dissimilar metallic restorations.

5. The phenomenon of polarization undoubtedly does reduce the current somewhat, but not to zero. Deposits on the metallic fillings may somewhat reduce the current, but insulation is probably very poor since these deposits are continuously saturated with electrolytes and are frequently removed by the process of oral hygiene.

6. The problem of determining all the possible sources of electromotive force in an oral cavity showing dissimilar restorations has not been solved. However, a rather elaborate series of experiments has been planned in which it is hoped to measure the electromotive forces of the various types of electric cells that exist in the oral cavity, the resistance of some of the current paths and some of the currents that result. By making quantitative measurements with suitable electrical apparatus and using some special restorations, it is hoped to determine whether the currents flow continuously. Additional studies of electrolysis in tissues having saliva contacts should afford an explanation of the deposition of metals in tissues near the electropositive metals.

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Medical Arts Bldg.

VALUE OF AUTOSUGGESTION IN THE THERAPY OF "BRUXISM" AND OTHER BITING HABITS

By PAUL J. BOYENS, D.D.S., San Francisco, Calif.

THE use of suggestive methods as aids in the correction of various types of psychic misfunctionings has been recognized in the various branches of medicine for many years. Employment of autosuggestion in the treatment of "bruxism" may not be so well known. Therefore, the results of a specific study should be of interest.

It may be well, to begin with, to trace certain psychologic concepts which are used to explain the mechanism of all suggestive reactions. The work of many psychologists proves that mind is more than consciousness because it is the abiding, even though changing, background of which consciousness is the foreground. Consciousness is always in rapid change, for it marks the place where the formed disposition and the immediate situation touch and interact. Consciousness includes only that of which we are aware. Biologically speaking, it arose late in the course of evolution. Lying in juxtaposition, but including the larger section of the mind, we find the unconscious. This term does not denote any anatomic section of the body, however, but is merely a concept used to cover those mental and emotional processes which cannot be recalled by an effort of attention. The deeper motives for our conduct take form in this area.

In the unconscious mind, impressions received either from the conscious mind or through other sensory avenues are given form and adjusted in accordance with primitive or atavistic behavior patterns.

Read before the California Academy of Periodontology, January 16, 1940.

As noted before, the conscious or reasoning mind is rather a late innovation in the long history of the mind. Therefore, conscious judgments are often at variance with more primitive motivations. Thus, the conscious mind may either wish to forget painful impressions or may store them away for later solution.

Owing to the peculiarities of relationship, the conscious mind is compelled to use as a sort of storehouse this so-called primitive or unconscious area. When the conscious mind has need of these impressions again, they may be so altered in texture that they can be used only in abnormal ways.

It is true, however, that the conscious mind does make use of, and control, the unconscious mind to a large extent. To exercise this control effectively for our therapeutic purposes, we can make use of autosuggestion.

Autosuggestion involves the repetition of a fixed and positive thought, worded in such a manner that the unconscious reaction is one of harmony and in accord with conscious demands. Autosuggestion must not be confused with psychoanalysis, which has to do with the uncovering of impressions, ideas and concomitant emotions, already buried in the unconscious. Unquestionably, psychoanalysis has its place, and some work has been done by Bertram Frohman along this line in the correction of bruxism.

Freud illustrates the difference between suggestion and psychoanalysis by saying that suggestion is like painting, while psychoanalysis is like sculpture. Painting adds something from the outside; sculp-

ture cuts away. Now with autosuggestion, we can relieve certain symptoms which in themselves may cause further trauma and hinder curative procedure.

AUTOSUGGESTION AS AN AID IN CORRECTING BITING AND GRINDING DURING SLEEP

It may seem a long step from periodontia to psychology, but we are dealing with a many-sided disease when we treat paradentosis. Because of its mixed causes, it takes in many divisions of the healing arts. Those who are in the habit of making close clinical observations agree that overstress or traumatic occlusion is quite generally a potent factor in both gingivitis and bone resorption. The general interpretation in this connection is that trauma occurs in eating, but it has long been recognized that the real trouble occurs from clenching or grinding during sleep, or unconsciously while awake, and is variously known as Karoli effect, stridor dentium, bruxism and occlusal neurosis. The last term, used by Tischler, is perhaps the most explanatory.

"Bruxism," as used in this article, may be defined to include inaudible clenching, audible gnashing, cusp tripping and abnormal contacts made during the most extreme and unsuspected mandibular excursions.

The term "bruxism" was first used by Samuel C. Miller. It is derived from the word "bruxomania." The latter term, according to Isador Hirschfeld, is derived from *la Bruxomanie,* and was first used by Marie and Pietkiewix in 1907 *(Revue de Stomatologie).*

However, while it is generally conceded that bruxism is occasionally present, it is not ordinarily recognized that its frequency is far greater than is realized by the average person. Almost 100 per cent of patients, when asked about it, honestly think they do not have this habit. During consultation, it is just as well not to insist that the patient has it, for patients who deny it at first will often, a month or even years later, tell you that they caught themselves chewing and grinding unconsciously. Others will be informed of the habit by their associates. Incidentally, the loudest grinding is often the least harmful.

Often patients complain that their teeth are sorest in the morning, and others complain of bleeding at night. As these signs, with many others, tend to show that the percentage of "sleep biters" is very high, we are, I think, safe in assuming that almost 100 per cent of those having some form of periodontal disease are or have been addicted to bruxism in some form.

Many times, we are asked, "What is the cause of this nervous manifestation?" The causes seem to be varied, but we may make the broad assertion that any physical discomfort (including dental) or mental unrest may be a cause. It would not be humanly possible to remove all the potential causes in a given case. Even if it were, we might not be able to stop it by removing its causes, for it may have become an unconscious habit, no matter how it was acquired originally. Naturally, a vicious circle is established.

Therefore, we are dealing with a habit wherein patients unconsciously traumatize the teeth, seemingly trying to chew them out of their sockets. This habit is not confined to the hours of sleep alone; many indulge in it while they are awake.

Correction of unconscious habits takes one into the field of applied psychology. For years, I have felt that suggestive therapeutics should have its place in this field of dentistry, yet none of my efforts showed the slighest promise until very recently a chance remark by a patient, an avowed "bruxomaniac," gave me the clue which prompted me to use suggestion in another form. Instead of having the patient make a negative suggestion, such as "I will *not* bite my teeth," I tried a suggestion in the affirmative: "I *will* awake myself when I bite my teeth." This suggestion seems to be most effective when used by the patient just when

he is about to drop off to sleep. The reason for this is that, in this twilight zone between waking and sleeping, the active, conscious mind is in abeyance so that suggestions may be planted in the unconscious mind with the idea that there shall be postautosuggestion phenomena.

Making use of this well-known principle—waking up at a predetermined time for a specific reason—is one of the most primitive of human reactions which fall into the category of autosuggestion. Before any of us were old enough to know what autosuggestion meant, most of us used it and experienced its efficacy. For example, when we had occasion and the desire to wake up earlier on a certain morning, we seldom failed to wake up if the urge was strong enough. This simple and familiar principle, practiced at some time by most of us, is the basis for these experiments in the correction of bruxism.

To carry these somewhat theoretical ideas out beyond the realm of conjecture and speculation, it was decided to experiment on a fairly large group of patients, tabulating and analyzing the reactions. Therefore, a fairly well systematized method was evolved which, to date, has been tried out on 100 patients, with interesting results.

METHOD OF PROCEDURE

As only a small percentage of patients are willing to believe that they have any nocturnal or unconscious biting habits, tact must be used to introduce this division of treatment, since it may be a radical departure from their own conception of what treatment should be.

It is well to explain, impersonally, to the patient that a great many persons have these habits, but are rarely conscious of them, and that they do their teeth, gums and dental work much harm. Therefore, just as a matter of precaution, we proceed to instruct the patient as to how to begin with the first suggestion, telling him to say, "I will catch myself if I bite or clench my teeth," and further telling him to repeat this statement from time to time during the day. It has been surprising to note how many, upon returning in a few days or weeks, had themselves discovered that they had unconsciously been biting, usually while under stress of some sort, or while concentrating, driving a car, playing golf, playing a musical instrument, etc.

Once the patient becomes convinced that he has been doing something he was not conscious of, his attitude changes from doubt to curiosity and interest. He then becomes more willing to cooperate wholeheartedly.

The next step then is for him to use the suggestion, "I *will awaken* if I bite or clench my teeth," just before going to sleep, and to repeat it whenever he awakens, from whatever cause. Some psychologists may suggest different wording for these affirmations.

This waking up, when biting, involves an additional mental process, that of waking for a specific reason, which requires more concentration and repetition, and has taken, in many instances, several months for achievement. It is most interesting to note that those who awakened themselves only after months of endeavor were invariably sound sleepers, who were accustomed to sleeping all night through and who had to be awakened in the morning.

In contrast to the sound sleepers, there are those who suffer from insomnia. It is with this class, which is small (about 5 per cent), that it is well to proceed a little more slowly in order to maintain the highest degree of cooperation. Stimulation of the mental faculties on retiring tends to keep the patient awake, which is undesirable. Interference from this source has been avoided by advising the patient to discontinue the "night suggestions," but continue with those for the waking hours. The latter often "carry over," and are thus also effective during sleep. It has further been found that pa-

tients may make suggestions during the day against nocturnal biting, and these seem gradually to become effective at night without producing any mental stimulation on retiring. It is well to have the patient augment his reactions on awakening by the simple affirmation "I will relax."

If reactions prove undesirable, the suggestions are discontinued, and the effects soon wear off.

Incidentally, alcoholics seem to have their own peculiar reactions along this line and so far have not been amenable to suggestion. While it would, of course, be advisable for them to reduce their alcoholic consumption, there probably are some underlying systemic or nervous factors which in themselves would cause a tendency toward overindulgence and to perpetuate their pathogenic biting habits. The ideal way of handling this type would, of course, be to have the cooperation of an internist or a psychiatrist. Autosuggestion should be expected not to cure a disease, but merely to correct a habit.

Some patients complain of becoming "tooth conscious," but that is the lesser of a number of evils, and usually they recover from it in a comparatively short time.

RESULTS IN ONE HUNDRED CASES

First let us consider the mental or psychic reactions of the 100 cases studied. They divided themselves into three main groups. The first group, comprised of twenty-two, includes those who have not, up to date, shown any reaction to suggestions. It can be said of the majority of them that they probably have no unconscious biting habits, a supposition which has been confirmed largely by their clinical records. Among them were twelve patients who had had surgical treatment for paradentosis. The usual postoperative complications, which are the result of biting or clenching, were conspicuously absent; namely, frequent loosening of the surgical packing, pain, soreness, bleeding and hypertrophy of the soft tissue.

In the remaining ten of this first group, as no biting habits have come to the surface, it is assumed that they are absent. It is not taken for granted, however, that the patients are free from biting habits since it sometimes requires months to uncover such habits.

The second group, twenty-four out of the 100, comprises those who have become conscious of daytime biting habits, but not of biting during sleep. However, as there is a tendency for their psychic response to develop, they often become convinced at a later date that they do bite in their sleep.

The fifty-four in group 3 are those who awaken more often than formerly, and are more or less completely convinced that clenching or grinding was responsible. The large majority of this group first caught themselves biting or clenching during waking hours.

DENTAL OBSERVATIONS WHICH CONFIRM THE PRESENCE OF PSYCHIC REACTIONS

While obviously these patients would have no valid reasons for saying that they experienced a reaction when they have not, and vice versa, in order to give these findings practical value there must be some clinical verifications of the patient's purely subjective symptoms. These have been noted, and, for the most part, patients are quite certain of their reactions. Those who were uncertain are not included in this list. Among the most significant observations are the decreasing sensitiveness and improved tissue tone of these patients (eighteen in number) who reacted satisfactorily from the psychic point of view. Those who had sore teeth or tired jaws upon awakening, or had spontaneous bleeding during sleep, were grateful for relief. While much of the improvement could logically be attributed to purely local treatment, it is of marked interest and of diagnostic value to note that the symptoms of about

twelve of these occasionally recurred during periods of stress, illness, trouble or discomfort or failure to sustain their suggestions, and again would improve promptly on a return to health, comfort and the resumption of autosuggestion. While there are only twelve in this particular group, the results are significant, as they definitely establish bruxism as a decisive factor in certain cases. Twenty-five of this group of fifty-four believe that they have discontinued all biting at night, a belief which of course may be subject to slight errors.

CONCLUSION

In reducing these findings to their simplest terms, it can be said that this form of autosuggestion makes, or tends to make, the patient conscious of a habit which heretofore had been unconscious. While specifically directed to check bruxism, there is the probability that autosuggestion may be applied to check other unconscious habits, such as lip or nail biting and thumb sucking.

It is axiomatic that voluntary discontinuance of a habit tends to become automatic.

Whatever success this type of suggestive therapy may prove to have can be attributed to making an affirmative suggestion, "I will," etc., instead of a negative one, "I will not," etc. These affirmations should be written out for the patients as they invariably get them reversed.

Discovery by the patient of his own unconscious biting or clenching habits during waking hours is of great diagnostic value and is often the first step toward his becoming conscious of bruxism during sleep.

Once the patient has learned to solve his own problem and is conscious of certain benefits, his corrective habits, with a little urging, automatically tend to perpetuate themselves.

To date, autosuggestion has by no means proved to be a substitute for bite adjustment by grinding, but merely an adjunct that is especially valuable in bites that cannot be perfected by any mechanical methods.

According to McCall, any dental discomfort or unusual biting sensation is in itself a cause of bruxism, but bite readjustment, along with other types of treatment, usually tends to correct the habit. Therefore, bruxism is a part of a vicious cycle.

When such a large percentage of patients (seventy-eight out of 100 showing some form of paradental disease) show unconscious biting habits, bruxism in some form must be reckoned with as a potential and common causative factor. Therefore, autosuggestion may well become an aid in the rational practice of dentistry.

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STUDIES IN TOOTH DEVELOPMENT: THE GROWTH PATTERN OF HUMAN TEETH

PART I

By ISAAC SCHOUR, D.D.S., Ph.D., and M. MASSLER, B.S., D.D.S., Chicago, Ill.

INTRODUCTION

THE human tooth is an organ of mastication consisting of a number of specialized structures. These may be classified into three groups:

1. The propriodontal structures (enamel and dentin), which are peculiarly characteristic of the tooth, similar tissues not being found elsewhere in the body.

2. The pulp (the formative organ of the dentin).

3. The parodontal structures (cementum, alveolar bone, periodontal membrane and gingivae), the supporting and investing structures of the teeth.

The Life Cycle of the Tooth.—The tooth as a living functional organ passes through the following developmental stages in a harmonious and sequential manner (Fig. 1):

1. Growth.

A. Initiation of development.

B. Proliferation of the tooth germ from the oral epithelium and subjacent mesenchyme.

C. Histodifferentiation of the formative cells of the tooth germ.

D. Apposition of the tissue matrix by the formative cells.

2. Calcification of the deposited matrix.

3. Eruption of the tooth into the oral cavity.

4. Attrition; i.e., wearing of the tooth with function.

Instead of the usual one or two developmental processes that participate in the formation of an organ, the tooth undergoes four such processes. The liver grows; bone grows and calcifies; but the tooth must not only grow and calcify, but must also erupt before it can carry out its masticatory function. Finally, the tooth is worn, as a result of function, according to a definite pattern.

Although the enamel, and to a lesser degree the dentin, are limited in their growth and calcification to very definite periods (Table 4), the remaining dental tissues (cementum, periodontal membrane and alveolar bone) continue to develop as long as the tooth remains in functional relationship with the dental apparatus (the jaws and the face). Under normal conditions, tooth development is therefore a lifelong process and thus more than a problem in embryology. It ends only with the extraction of the tooth. In fact, the objective of clinical and preventive dentistry may be defined as the maintenance of each tooth in function during its entire life cycle.

Methods of Study.—This paper will be concerned with the growth of enamel and dentin. The calcification, eruption and attrition of teeth will be considered in subsequent reports.

Instead of giving the usual histologic description of embryologic stages of tooth formation, we shall attempt to trace and

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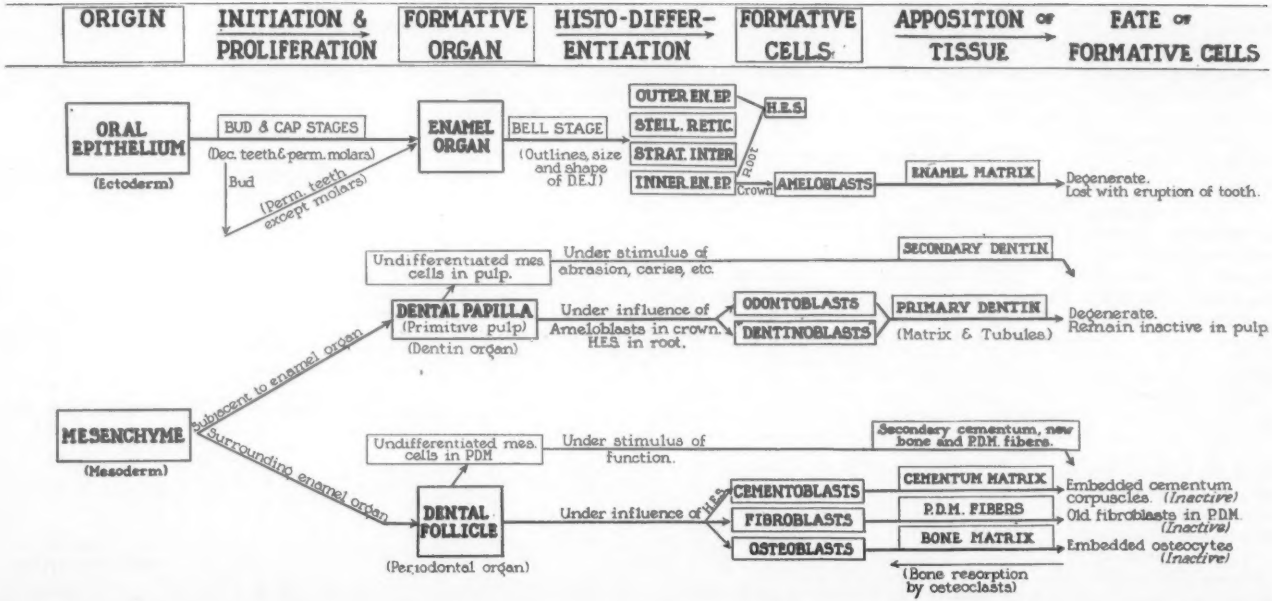
TABLE 1.—LIFE CYCLE OF FORMATIVE CELLS OF DENTAL STRUCTURES.



D.E.J. = Dentino-Enamel Junction
H.E.S. = Hertwig's Epithelial Sheath.
P.D.M. = Periodontal Membrane

TABLE 2.—DEVELOPMENTAL PHYSIOLOGY OF THE TOOTH

Phases in Development	Physiologic Characteristics	Sensitivity to Experimental Interferences	Methods of Measuring	Aberrations in Development	Experimental Conditions Showing Specific Disturbances
Growth (a) Initiation and proliferation	Cell multiplication	Low	Number of mitotic figures	Disturbances of all subsequent phases of growth	Colchicine and lead poisoning (deficient proliferative growth) Hypovitaminosis A (uninhibited proliferation of enamel epithelium and invasion into pulp)
(b) Histodifferentiation	Cell differentiation and assumption of definitive form plan (e.g., outlining form of tooth)	Increased	Cytologic changes and positioning of cells	Irregular form of tooth and atypical structure of matrix formation	Hypovitaminosis A (atypical dentin formation and form of pulp)
(c) Apposition	Secretion and deposition of matrix by formative cells	Most sensitive phase in growth	Vital staining (alizarin, sodium fluoride, trypan blue, etc.)	Hypoplasia (deficient amount of matrix formation)	Hypovitaminosis A (markedly disturbed gradient of growth; enamel hypoplasia and vascular inclusions in dentin)
Calcification	Precipitation of calcium salts in protein matrix, following apposition in close incremental succession Enamel and dentin, unlike bone, not subject to calcium withdrawal	Most sensitive phase in development; sensitive to even normal variations in body metabolism; reflects constitutional status of individual (neonatal adjustment, weaning, infancy, etc.)	(a) X-ray densiometer (b) Histologic staining reaction (c) Degree of fusion of calcospherites (d) Vital staining	Enamel immature and acid resistant, chalky and fragile Dentin showing non-fusion of calcospherites (interglobular and fragile dentin), wide predentin Cementum and bone with wide osteoid and precementum borders	Hypovitaminosis D (wide predentin and interglobular dentin) Parathyroidectomy (interglobular dentin) Fluorosis (chalky-white opacity of enamel)
Eruption	Extrusion of the formed and calcified tooth into	Very easily affected by local conditions; less	Marking of tooth by notching; x-rays	Deficient eruption, submersion	Local: Traumatic occlusion causing decreased

	the oral cavity by a	readily affected by		Excessive eruption,	rate of eruption; re-

	the oral cavity by a force acting at its basal end Opposition by incisal or occlusal stresses so that the eruption potential is not fully expressed	readily affected by systemic factors		Excessive eruption, elongation (supra-occlusion) Perverted eruption, malposition of tooth	rate of eruption; removal or fracture of antagonists allowing for increased rate of eruption Systemic: Hypophysectomy, thyroidectomy; decreased rate and final cessation of eruption
Attrition	Result of functional wear, compensated by continuous eruption of tooth and growth of periodontal tissues		Marking of tooth by notching	Deficient attrition, elongation (supra-occlusion) Excessive attrition, abnormal wearing of crown	Local: Deficient wear due to removal of antagonist; abnormal wear due to excessive muscular function Systemic: Deficient calcification of enamel (fluorosis) resulting in abnormal attrition

analyze tooth growth according to the stages of:

1. Initiation
2. Proliferation
3. Histodifferentiation
4. Apposition. This phase of growth will be discussed in greater detail in terms of (a) the pattern of cellular activity and (b) the resultant incremental pattern.

A quantitative analysis of the cellular activity and growth potential of the formative cells will be given in a separate report (Massler and Schour[1]).

A histologic and physiologic study of enamel and dentin reveals in a striking manner the law and order which prevail in tooth development. There is a definite and beautiful plan of growth which makes certain that the phylogenetically derived forms of the teeth are faithfully reproduced. Vital staining with sodium fluoride (Schour and Poncher[2]) and alizarin red S has made it possible to trace and evaluate the pattern of cellular activities that give rise to these structures and to recognize the laws of growth which these cells obey. This method allows for a quantitative analysis of normal processes and the effects of experimental interference (Schour, Smith and Hoffman[3]).

In this report, emphasis will be placed on the dynamic changes that characterize development. We shall be concerned more with form than histologic structure; with cellular dynamics than cytologic details, and with quantitative analysis rather than microscopic descriptions. Our approach is therefore histophysiologic rather than histologic.

Clinical Applications.—Many clinical conditions that confront dentistry are the result of developmental disturbances, and, therefore, they can be understood only so far as normal development is understood. When viewed in this light, suppression of the teeth is the result of disturbances in the initiation of growth; odontomes and cysts are the result of

TABLE 3.—CLASSIFICATION OF ABERRATIONS IN TOOTH DEVELOPMENT.

disturbances in proliferation and histodifferentiation; enamel hypoplasia is a disturbance in appositional growth; rickets, a disturbance in calcification, and impaction and certain types of malocclusion are aberrations in eruption (Table 3). Such correlations will be discussed at the end of each section under histophysiologic and histopathologic comment.

INITIATION

At ten points on the epithelial border of the embryonic jaw, each corresponding in position to the future ten deciduous teeth, particular cells of the basal layer begin to proliferate at a more rapid rate than do the adjacent cells (Fig. 2). These cells contain the entire growth potential of the tooth just as the fertilized ovum contains the entire growth potential of the individual.

The permanent molars arise, like the deciduous teeth, directly from the dental lamina, while the other permanent teeth develop from buds of their deciduous predecessors. Table 4 gives the chronology of tooth growth.

Histophysiology.—A lack of initiation is evidenced as an absence of teeth. This may occur in isolated areas, most frequently in the permanent upper lateral incisors and lower bicuspids, or there may be a complete lack of teeth (anodontia). On the other hand, initiation may occur in an abnormal number, resulting in single or multiple supernumerary teeth (Table 3).

The stimulus to initiation is not known. Recent researches indicate that there are specific chemical factors necessary for initiation (Needham[4]). Should these factors be discovered and utilized, it would be possible artificially to induce the development of teeth in edentulous areas or jaws.

Histopathologic Comment.—Teeth may develop in abnormal positions such as the uterus (dermoid tumors or cysts) or hypophysis (Schurmann *et al.*[5]). In every instance, the tooth develops from the ectodermal layer and undergoes the same stages of development as in the jaws (except for attrition). Initiation is possible at such sites because of the presence of (a) odontogenic epithelium or epithelial cells with the potential for tooth formation plus (b) initiating and differentiating substances (morphogenetic hormones[4]).

PROLIFERATIVE GROWTH

Definition.—Proliferative growth is the result of cellular division and is, therefore, multiplicative; that is, growth proceeds in geometric progression. It constitutes the most rapid phase of growth and is characterized by marked alterations in the form of the growing organ. The tooth germ or formative organs of the tooth structures is elaborated at this stage (Fig. 3).

Enamel Organ.—As a result of cellular multiplication, a bud of epithelial cells is formed (Fig. 2). Continued proliferation results successively in the bud, cap and bell stages of the enamel organ with the characteristic layers of cells shown in Figure 3.

Dental Papilla and Dental Sac.—Under the organizing influence of the proliferating enamel organ, the subjacent connective tissue proliferates and condenses to form the dental papilla (Fig. 3). In a similar manner, the connective tissue surrounding the enamel organ and dental papilla condenses and forms the dental sac (Fig. 3).

Tooth Germ.—The tooth germ, therefore, consists of three formative organs:

(a) The enamel organ, derived from epithelium, which will form the enamel.

(b) The dental papilla (or "dentin organ"), derived from mesenchyme, which will form the dentin and remain within the central cavity of the dentin as the pulp.

(c) The dental sac (or "periodontal organ"), also derived from mesenchyme, which will form the supporting structures of the tooth, the cementum, alveolar

bone and periodontal membrane (Fig. 3 and Table 1).

Histophysiologic Comment.—During these stages, the tooth germ contains the entire growth potential of the future tooth. This is evidenced by the fact that explants of these early stages continue to develop in tissue culture through the subsequent stages of histodifferentiation and appositional growth (Glasstone[6]).

HISTODIFFERENTIATION

Definition.—The third phase in the growth of the tooth is one of cellular differentiation and the assumption of the morphologic pattern or future form of the tooth. Two distinct events occur at this stage:

(a) The formative cells of the tooth germ elaborated at the proliferative stage undergo definite histologic as well as chemical changes and acquire their functional assignment (the appositional growth potential). The organizing influence of the epithelial cells upon the mesenchyme is manifested at this time.

(b) They arrange themselves along a site which outlines and defines the future form and indicates the size of the tooth.

Histodifferentiation marks the end of the proliferative stage and is often inseparable from it on a morphologic basis. The cells give up their capacity to multiply as they assume their new function (a law which governs all differentiating cells). This phase reaches its highest development in the bell stage of the enamel organ just preceding the beginning of apposition of enamel and dentin (Fig. 4).

Enamel Organ.—The inner enamel epithelium undergoes histologic changes. At the same time, its cells exert an organizing influence upon the subjacent mesenchymal cells, which then differentiate into odontoblasts. In the meantime, the inner enamel epithelium has been arranged so that the boundary between it and the odontoblasts outlines the future dentino-enamel junction. The inner enamel epithelium now differentiates into ameloblasts. These cells then lose their capacity to divide and acquire the specific potentiality to secrete the enamel matrix.

The dentino-enamel junction, which is different and characteristic for each tooth class, acts as the blueprint pattern, and against this area the ameloblasts and dentin-forming cells will deposit enamel and dentin matrix, and thus give to the completed tooth its characteristic form and size. For example, the full size and form of the first permanent molar is established at birth when its appositional growth begins (Beust[7]). The frequent statement in the literature that endocrine disturbances affect the size of the teeth is therefore theoretically not tenable unless such effects occur prior to or during the stage of histodifferentiation; that is, *in utero* or in the first year of life. Clinical examination shows that the retarded eruption which occurs in hypopituitary and hypothyroid cases results in a reduction in size of the clinical crown, which is often mistaken for a small sized tooth. The size of the anatomic crown is not affected (Schour and Massler[8]).

Hertwig's Epithelial Sheath.—At the margins of the bell-shaped enamel organ, the inner and outer layers of the enamel epithelium proliferate and give rise to Hertwig's epithelial root sheath, as seen in Figure 5. This epithelial sheath outlines the dentino-cemental junction and acts as the blueprint pattern for the shape, size and length of the root or roots, just as the inner enamel epithelium outlines the shape and size of the crown. In addition, the epithelial sheath initiates the differentiation of the radicular odontoblasts and probably of the cementoblasts, just as the ameloblasts initiate the differentiation of the coronal odontoblasts. As soon as the formation of the dentin and cementum of the root is begun, the sheath disintegrates and vestiges can be found later as epithelial rests in the periodontium.

Dental Papilla and Dental Sac.—Be-

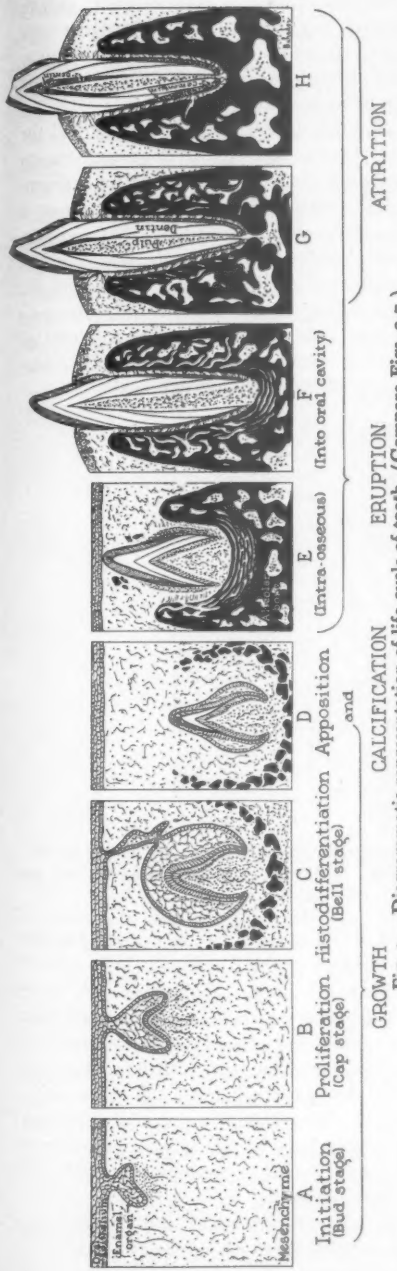


Fig. 1.—Diagrammatic representation of life cycle of tooth. (Compare Figs. 2-7.)

fore the inner enamel epithelium differentiates into ameloblasts, the peripheral cells of the subjacent mesenchymal dental papilla or primitive pulp undergo histodifferentiation under the organizing influence of the epithelium. They assume a tall columnar form and acquire a specific potentiality to take part in dentin formation (odontoblasts) (Fig. 4).

In the root, the histodifferentiation of the odontoblasts from the dental papilla takes place under the influence of the inner layer of Hertwig's epithelial sheath.

In a similar manner, the mesenchymal cells of the dental sac immediately adjacent to and probably under the organizing influence of the outer layer of Hertwig's epithelial sheath differentiate into cementoblasts (Table 1).

Epithelial Chemotaxis.—V. Brunn and others have shown that the presence of the inner enamel epithelium is essential to the differentiation of the odontoblasts and the initiation of dentin formation. However, once they are differentiated and their functional potential is acquired, they can proceed with dentin formation without the presence of the epithelium. Thus odontoblasts transplanted into an epithelial field (skin or kidney epithelium) will begin the formation of dentin in from ten to fourteen days (Huggins[9]). A reverse relationship occurs as soon as dentin formation begins. Enamel will not form in the absence of dentin (Huggins,[9] Glasstone[6]). Transplanted ameloblasts fail to form enamel unless the odontoblasts accompany the transplant. Dentin formation, therefore, precedes and is essential to enamel formation, although the differentiation and chemotactic influence of the epithelial cells precede and are essential to the differentiation of the dentin-forming cells and the initiation of dentin formation. The chemical influence of epithelial cells upon adjacent mesenchymal cells is not only evidenced in the tooth but has also been demonstrated in bone growth. Transplantation of epithe-

lium of the gall-bladder or urinary tract distal to the kidney causes the differentiation of the adjacent mesenchymal cells into osteoblasts and initiates the formation of bone (Huggins[9]).

Histophysiologic Comment.—Development requires first an activator (initiation) and, secondly, a specific pattern-maker (histodifferentiation) to direct the non-specific growth potential. The growth energy released at the initiation of development is unorganized and must be distributed according to a definite growth pattern. The process of differentiation is like the direction of a stage play. It occurs in that period in development at which the rôles of the individual cells are assigned, the cues fixed and the appearances timed. The orderliness of the actual performance which follows is entirely dependent on the proper differentiation of the cells (Weiss,[10] p. 482).

Growth is characteristically rhythmic in nature, periods of activity alternating with periods of rest. Cell differentiation and the acquisition of a new potential function are synchronized with the rest periods in growth. Histodifferentiation thus marks the end of proliferative activity and is the essential forerunner of appositional activity. Appositional growth cannot begin until the formative cells have acquired the potentiality to perform their work and have given up their power to reproduce.

Should differentiation not occur, the non-specific, unorganized growth energy expresses itself in the continued unhampered proliferation of cells. A tumor is therefore characterized by the unorganized proliferation of cells and the undifferentiated embryonic nature of the cells. The degree of non-differentiation of the cells is an index to the rate of proliferation and therefore to the malignancy of the tumor (Broders[11]).

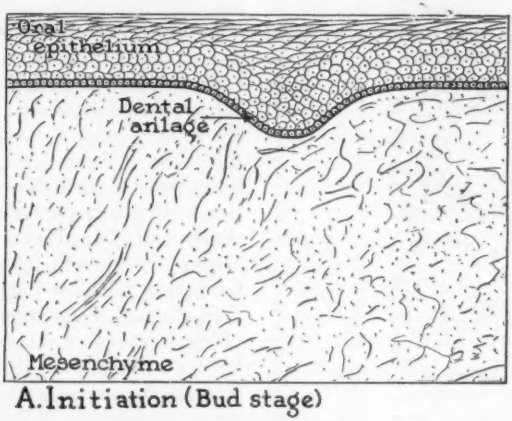


Fig. 2.—Diagrammatic representation of odontogenesis (lower second deciduous molar): Initiation; primary stage in the growth of the tooth; beginning of proliferation of oral epithelium to form budlike dental anlage (denal lamina). (Compare Figs. 3-7.)

Table 2 summarizes the developmental physiology of the tooth.

Histopathologic Comment.—A given disturbance or experimental interference will have entirely different effects, depending on the time of its occurrence and the stage of development which it affects. Aberrations in tooth development can therefore be classified according to the stage of development at which they occur (Table 3).

If aberrations occur during the stage of proliferative growth, new parts may be differentiated (supernumerary teeth,

extra cusps or roots); twinning may result (fusions), or a complete suppression of parts may occur (loss of cusps, roots or the entire tooth) (Table 3). The resultant seems to depend on the severity of the disturbance rather than upon its specific character.

A pinching off of a few cells of the enamel organ during its proliferative growth results in epithelial pearls or rests. These rests may remain quiescent or become activated under the stimulus of irritation. In the latter case, the cells will merely proliferate if they remain untrix in the manner to be described in normal appositional growth. In the latter case, a true odontome, simple, compound or complex, would result. Odontomes and cysts can thus be defined as the result of aberrations in the development of the enamel organ and can be classified according to the stage of differentiation of the aberrant cells in the manner suggested by Tratman.[12]

Similar behavior of cells may be noted in transplants. If very young undifferentiated epithelial cells are transplanted, only proliferation of the cells will occur.

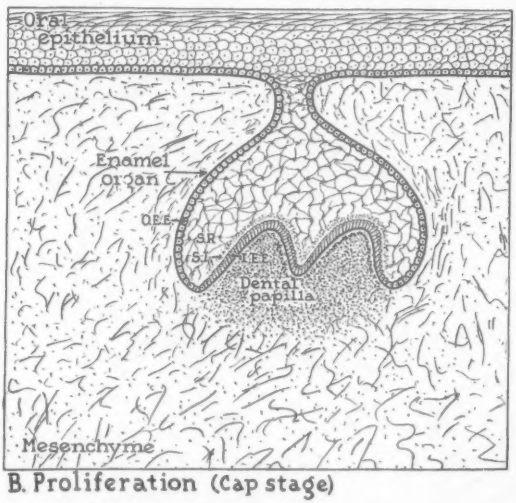


Fig. 3.—Odontogenesis: Proliferation; epithelial proliferation and invagination resulting in cap-shaped enamel organ. The underlying mesenchymal tissue is condensed and forms the dental papilla. OEE, outer enamel epithelium. SR, stellate reticulum. SI, stratum intermedium. IEE, inner enamel epithelium.

differentiated. Should the cells become partially differentiated or become detached from the enamel organ in a partially differentiated state, they would assume the secretory function common to all epithelial cells, and a cyst would result. However, should these cells become fully differentiated, or be detached from the enamel organ in a fully differentiated state, they would acquire the function of secreting enamel and dentin ma-

If partially differentiated cells (gingivae) are transplanted, cysts will result (epithelium consisting basically of secretory cells). If fully differentiated cells (ameloblasts, odontoblasts, osteoblasts) are transplanted, true matrix formation will result (Huggins,[13] Glasstone[6]).

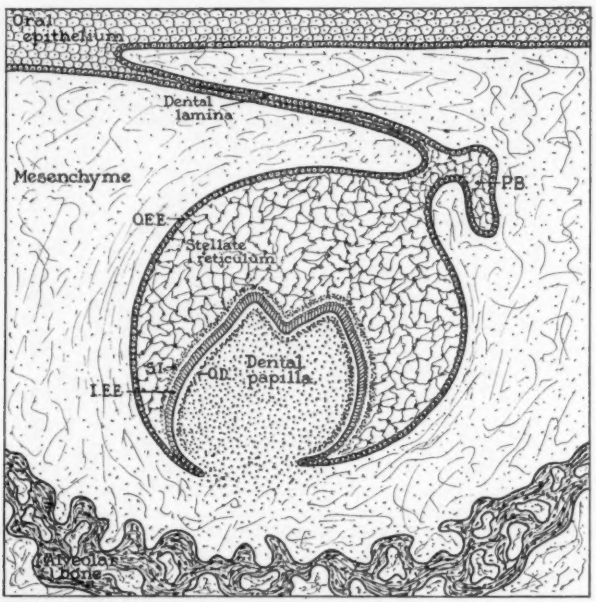
Aberrations in development occurring in the stage of histodifferentiation may disturb the form and size of the organ as well as the function of the formative

cells. In the case of the peg lateral incisor, the form and size of the tooth are disturbed without impairment of the function of the formative cells. The quality of the enamel and dentin is unaffected. On the other hand, the differentiation of the formative cells and therefore the quality of the enamel and dentin may be affected without influencing the size or form of the tooth.

In dentinogenesis imperfecta[14] (hereditary opalescent dentin[15]), the odontoblasts fail to differentiate completely. The result is the formation of dentin matrix, with an absence or disarrangement of the dentinal tubules, resembling irregular secondary dentin. The form of the tooth and the quality of the enamel are normal (Fig. 7).

In vitamin A deficiency, the ameloblasts fail to differentiate properly. In consequence, their organizing influence upon the adjacent mesenchymal cells is disturbed, and epithelialization of the pulp and atypical osteodentin formation result (Mellanby,[16] Schour, Smith and Hoffman[3]).

The form and size of the tooth can be affected only if a disturbance occurs at the bell stage of the enamel organ when the morphogenetic pattern of the tooth is outlined. If the disturbance occurs immediately after that moment, the form of the tooth will be unaffected, but those



C. Histo-Differentiation (Bell stage)

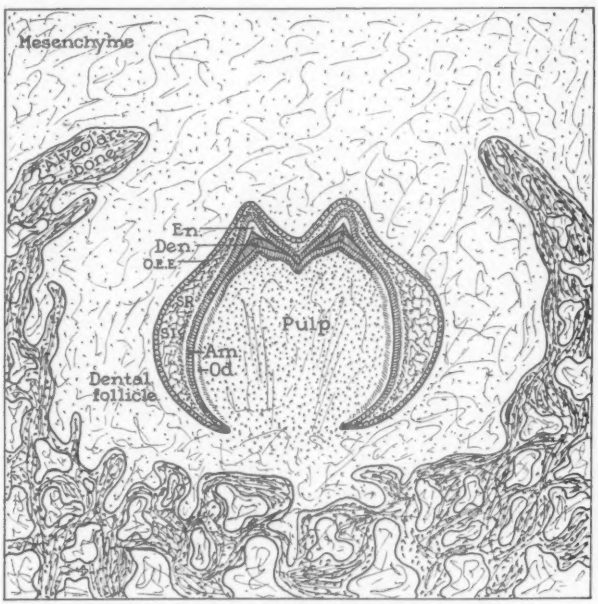
Fig. 4.—Odontogenesis: Histodifferentiation. The enamel organ is bell-shaped and outlines the shape and size of the future crown. The cells of the inner enamel epithelium now give up their mitotic activity, undergo histologic changes and assume their new function as ameloblasts. (Table 1.) Under the influence of these ameloblasts, the peripheral cells of the dental papilla also differentiate into the columnar odontoblasts and assume a new function in dentin formation. The permanent tooth bud (PB) arises from the dental lamina of its deciduous predecessor and undergoes the same stages in development. OEE, outer enamel epithelium. SI, stratum intermedium. IEE, inner enamel epithelium.

cells that are differentiating or functioning at the time will be disturbed, and with them also the quality or amount of the enamel and dentin which they produce.

APPOSITIONAL GROWTH (AMELOGENESIS AND DENTINOGENESIS)

Definition.—Appositional growth is the result of a layer-like deposition of a non-vital extracellular secretion in the form of a tissue matrix. This type of growth is therefore additive. It represents the fulfilment of the plans outlined at the stage of histodifferentiation. Appositional growth is characterized by a regularity and rhythmicity in the deposition of the extracellular material, periods of activity and rest alternating at definite time intervals, and by the fact that the deposited material is of itself incapable of further growth.

There are thus two main types of growth: one of proliferative cell-division or growth by multiplication, and the other of extracellular apposition or growth by addition (Huxley[17]). Both are specialized forms of cellular activity, cell division and cell secretion.



D Apposition of Enamel and Dentin.

Fig. 5.—Odontogenesis: Apposition of enamel and dentin; deposition of enamel matrix (En) by ameloblasts (Am) (differentiated cells of the inner enamel epithelium) from within outward; concomitant deposition of dentin matrix (Den) by odontoblasts (Od) and "dentinoblasts" from without inward. Collapse of the stellate reticulum (SR) immediately over each growth center and approximation of the outer enamel epithelium (OEE) to the ameloblastic layer probably permit a greater nutritive supply to the ameloblasts. The peripheral coalescence of the two growth centers and the formation of a groove are to be noted. (Compare Figure 17.) SI, stratum intermedium. The dental papilla is now called the pulp.

Appositional growth differs from other types of cellular secretions only so far as the secretion is of a more viscid nature and becomes hard and calcified. This type of secretion, therefore, becomes

more permanent and can be readily observed and measured.

The matrix is deposited by the cells along the site outlined by the formative cells at the state of histodifferentiation (the future dentino-enamel and dentino-cemental junctions) and according to a definite pattern of cellular activity, which is common to all classes and forms of teeth. The growth potential acquired by the formative cells at the histodifferentiation stage is therefore expressed according to very definite and universal laws of growth. These laws for the most part have been elucidated in growth studies of various other organs and organisms by Thompson,[18] Huxley,[17] Weiss[20] and others.

The process of appositional growth can be compared with the construction of a house. The blueprints (the dentino-enamel and dentino-cemental junctions) outline the form and size of the structure and are different for each class of tooth. However, the workers (cells), the materials used (nutritive elements), the materials elaborated (enamel and dentin) and the methods of construction (the pattern of cellular activity) are common to all classes and forms of teeth.

Appositional growth will be described in two parts. The first will concern it-

E-Incremental Pattern.

Fig. 6.—Odontogenesis: Incremental growth pattern; pattern of deposition of layers of enamel and dentin. A single layer of enamel and dentin, about 4 microns in thickness, is deposited daily. Each layer is therefore termed a daily increment. REE, reduced enamel epithelium composed of degenerating outer enamel epithelium, stratum intermedium and ameloblasts. OD, odontoblasts. The Hertwig's epithelial sheath (HES) is formed by proliferation of the outer and inner enamel epithelium. It outlines the shape and size of the future root and probably stimulates the cells of the dental follicle (DF) to form the cementum, after which it disintegrates and is lost. Remnants may be seen as epithelial rests in the adult periodontal membrane.

self with the cellular dynamics or the pattern of cellular activity and the manner in which the enamel and dentin matrices are laid down. The second will consist of a description of the incremental growth pattern that results from the integrated activities of the cells.

The Pattern of Cellular Activity.—The formative cells (bricklayers) begin their work at specific sites (growth centers) as soon as the blueprint (the dentino-enamel junction) is completed and their assignment is assured (establishment of growth potential at histodifferentiation). The form and size of the tooth (house) determines the number of cells (workers) to be employed. The work then proceeds along a common plan

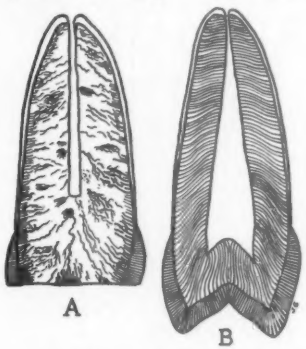


Fig. 7.—A, diagram of labiolingual ground section of bicuspid, showing characteristic changes in dentinogenesis imperfecta (hereditary opalescent dentin). The irregular course and small number of dentinal tubules, the marked abrasion and the filling in of the pulpal cavity are to be noted. B, diagram of ground section of normal bicuspid; showing contrast in appearance and contour of enamel, dentin and pulpal cavity. (Roberts and Schour, Am. J. Orthodontics, 1939).

which assures the expression of the growth potential according to a definite pattern.

Path of Cellular Activity.—Amelogenesis: The cells (workers) take the raw materials from the blood stream and prepare and deposit them in the form of globules, one upon another. The ameloblasts elaborate the pre-enamel granules between the nucleus and the enamel end of the cell. These are small calcospherite formations which grow larger by fusion as they proceed toward the proximal (or enamel) end of the cell. They are secreted by the ameloblasts daily in the form of a single globule approximately 4 microns in diameter. Each globule thus represents a large calcospherite and is deposited one upon another until a column-like enamel prism is produced (Figs. 8, 9). These globules are deposited in much the same manner as in the construction of a brick wall, and are held together by a cementing medium, the interprismatic cementing substance. The globules do not fuse completely and are demarcated by the cross-striations seen in the completed enamel. The pressure of succeeding depositions of globules causes compression, so that they appear somewhat flattened.

The deposition of the globules and the concomitant recession of the ameloblasts outward from the dentino-enamel junction occur in a regular and rhythmic manner. Each globule, therefore, represents the daily unit of ameloblastic activity, and the enamel rod represents the path of ameloblastic activity.

Dentinogenesis: The dentin matrix, unlike the enamel, is deposited not in globular units, but in a rather viscid fluid state, which soon becomes calcified. This deposition is comparable to the construction of a cement wall. The cement is poured layer upon layer into a mold, the pattern of which is previously determined, by the dentino-enamel junction and the dentino-cemental junction. The successive incremental layers are therefore not so sharply demarcated as in the enamel.

The formative cells of the dentin matrix are not as yet definitely known or established. The matrix is first deposited by the formative cells (which, when discovered, should be called dentinoblasts) as the uncalcified, precollagenous pre-

dentin layer. The so-called Korff's fibers course spirally between the odontoblasts and become an integral part of the matrix as the fibrillar substructure and act as a binding substance just as straw is used in making bricks or fibers in making a hydrocolloidal impression material. While there appears to be no question concerning the secretory nature of the ameloblasts in the appositional growth of the enamel, the mode of dentin matrix formation is not yet established.

The peripheral cells of the pulp (odontoblasts and dentin-forming cells) recede in synchrony with the matrix deposition. During this process, the odontoblasts leave behind them long protoplasmic processes (the dentinal fibrils), which become enclosed within the dentin matrix, forming long tubes (the dentinal tubules). These act as nutritive and sensory channels. The dentinal tubule, therefore, represents the path of cellular activity during dentin formation, just as the enamel rod represents the path of ameloblastic activity.

Histophysiologic Comment.—The odontoblasts form the dentinal fibrils, but are not necessarily responsible for the actual matrix formation. Atypical dentin can be formed under certain conditions (secondary dentin, dentinogenesis imperfecta) without the presence of the odontoblasts or dentinal tubules.

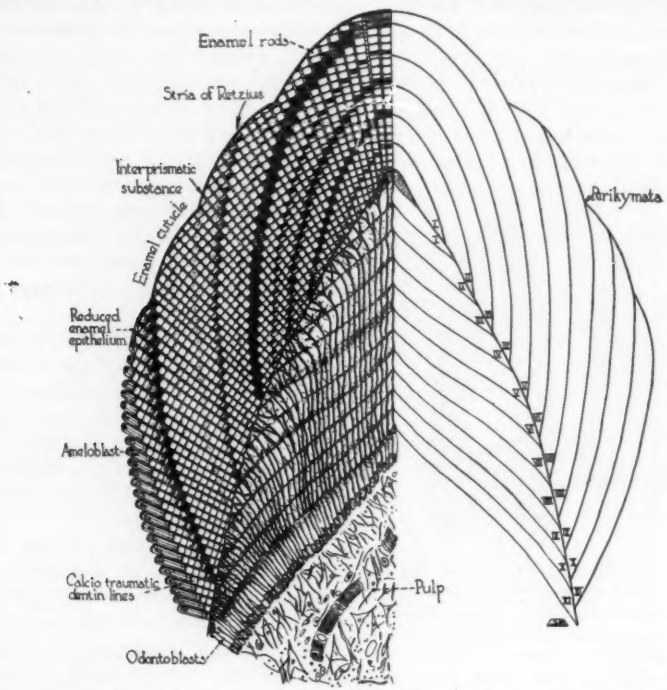


Fig. 8.—Diagram showing pattern of cellular activity. On the right is shown the daily deposition of a globule of enamel matrix by each ameloblast (daily rhythm in cellular activity) and the daily initiation of a new cell in the formation of enamel (daily successional onset of cellular activity). The integrated pattern of this cellular activity is the formation of a cone-shaped daily increment, shown on the left. A given increment is serrated or step-shaped in high power (right), but appears smooth under low power (left).

"Vitality" of enamel, dentin and bone: During the deposition of the tissue matrix, the formative cells are liable to become encapsulated (as in the formation of bone); or only cellular processes may become embedded (as in the formation of dentin), the cells themselves escaping this fate; or neither the cell nor any cellular process may be embedded (as in the formation of enamel). We are wont to term the first two tissues "vital" by virtue of the vitality of the encapsulated cells or cellular processes. It should be borne in mind, however, that the matrix

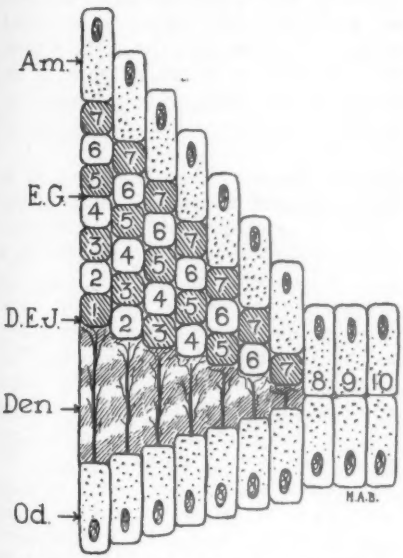


Fig. 9.—Pattern of cellular activity. (Compare Fig. 8.)

portion of these structures is an extracellular secretion which is dead and calcified. It can be added to or removed by subsequent cellular action (apposition and resorption), but this does not endow the matrix with "vitality" any more than the remodeling efforts of the mason confers vitality on the bricks. The entombment of a mason within a wall of bricks would not confer vitality on these bricks, even when he changes the structure of the walls. Enamel has neither encapsulated cells nor embedded cellular processes, nor even proximity to formative or resorptive cells after its formation is completed. It is a dead structure.

The Daily Successional Rhythmicity of the Onset of Cellular Activity.—The dentino-enamel junction or blueprint pattern of the tooth form is characterized by definite high points upon its surface which correspond in number and position to the cusps (in the posterior teeth) or lobes (in the anterior teeth) of the completed tooth (Figs. 10, 12, 13, 14, 15). These, the appositional growth centers of the tooth (formerly called calcification centers), are characteristic, in number and position, of the form of the tooth. Cellular activity begins at these points at a maximal velocity and spreads peripherally at rhythmic daily intervals along the dentino-enamel junction like the ripple caused by a pebble thrown into calm water.

The Integrated Pattern of Cellular Activity.—Cellular activity thus proceeds in two directions: 1. Successive cells begin their activity along the dentino-enamel junction at successively later daily intervals. 2. Each individual cell recedes rhythmically from the dentino-enamel junction. The integration of these two components of cellular activity results in successive rhythmic increments of matrix deposition, which constitute the basic incremental growth pattern of the tooth (Figs. 8, 9).

A given incremental layer of enamel and dentin has, therefore, in three dimensions, the shape of a cone with the apex directed occlusally and with the base resting against the dentino-enamel junction (Fig. 6). Since enamel formation proceeds from within outward, the enamel cones are deposited one on top of another; and since dentin formation proceeds from without inward, the dentin cones are deposited one within the other at the expense of the enclosed pulp (Fig. 6).

(To be continued)

THE CENTENNIAL OF AMERICAN DENTISTRY

By Arthur H. Merritt, M.S., D.D.S., Sc.D., New York, N. Y.

I. INTRODUCTION

NEVER, perhaps, in its history has the American Dental Association met under conditions of such world wide disorder, when the very foundations of civilization are being assailed by a barbaric force unparalleled in modern history. It is little wonder that under such conditions as these, when all that mankind has been taught to revere is being trampled in the dust, men should ask as did Nicodemus of old, "How can these things be?" How, they question, is it possible to explain, after 2,000 years of such precepts as those taught in the Sermon on the Mount, the utter disregard for every human right so ruthlessly exhibited by whole nations of people in this twentieth century? Why, they ask further, should millions of people prefer a form of government that denies to them the first principles of human liberty?

These are questions which thrust themselves upon us as we come together to celebrate the centenary of American dentistry. I allude to them because, it seems to me, every one must be sensible of their importance, must, in fact, feel the responsibility which they impose upon us, who for generations have known the meaning of freedom as has no other nation on earth. It is not of these things, however, that I wish to speak, but rather of what a century of progress in the science and art of dentistry means to the health and well-being of the human race. In a world torn with strife and bloodshed, it is well that we should turn aside for a moment to contemplate the fruits of peace and to reassure ourselves that the things of the spirit are mightier than all the forces arrayed against them and must in the end prevail.

II. EARLY STEPS IN THE EVOLUTION OF DENTISTRY

Dentistry, when it first emerged on the pages of history, was practiced as a part of medicine. As long as it consisted simply of measures for the relief of pain, this was possible. When, however, in the course of time, there arose a demand for a more constructive service, the separation from medicine began. The first sign of this separation may be said to have appeared about the middle of the sixteenth century, when a monograph was published in which dental affections were referred to for the first time independently of general medicine. The gap then developing continued to widen as the art of dentistry advanced. This growth has been preceded by such epoch-making events as the invention of printing in 1436; the conquest of Constantinople by the Turks in 1453; the subsequent migration of Greek scholars throughout the civilized world, and, perhaps most important of all, the discovery of America. These events of the fifteenth century mark the beginning of a new era, and gave birth to the revival of the arts and sciences. It was in the midst of this vigorous intellectual life that dentistry may be said to have begun to separate from general medicine—a separation, however, which did not become complete for nearly three hundred years.

III. DENTISTRY IN THIS COUNTRY

In the Western World, the first attempt to provide for the dental needs of

President's Address at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 9, 1940.

the public was made in 1630—only ten years after the landing of the Pilgrims—when there were brought over from England three barber-surgeons, who were to that small colony along the Massachusetts coast all things—barber, dentist and surgeon. Not until 1735, when a wigmaker by the name of Mills advertised in the New York press his qualifications for the extraction of teeth, is there any further mention of dentistry in this country.

Beginning about 1750 and continuing to the latter part of the eighteenth century, there came to these shores from Europe a few men versed in the art of dentistry according to the standards of those days, bringing with them a higher type of dental service than was at that time available in this country. To these men, there were apprenticed a few students, who, after a brief period of training, engaged in the general practice of dentistry. There being no laws regulating dental practice, charlatans, along with those who were better trained, abounded, practicing their crude art in the larger towns and cities along the Atlantic seaboard.

Such were the conditions when, in 1834, a few dentists in the City of New York came together to form the first dental society in this country. This organization was followed in 1839 by the publication of a dental journal and, one year later, the founding in Baltimore of a dental school, which, like the journal, was the first of its kind in the world. On this foundation of dental organization, dental literature and dental education, dentistry undertook to build its professional edifice. In doing this, it definitely separated itself educationally from conventional medicine and started on its independent course. There is a legend to the effect that the founders of that first dental school had previously sought to engraft dental education upon medical education through inclusion of a chair of dentistry in the University of Maryland School of Medicine. There is no proof that this is so. On the contrary, it seems to have been the belief of those early pioneers, some of whom had been medically educated, that the technical procedures inseparable from dental practice could not be successfully taught in a medical school. Nor, in their opinion, could they be mastered, plus a medical education, in the two years then required for graduation in medicine. To superimpose the technical procedures of dental practice on a medical education would require more time for graduation in dentistry than in medicine. This created an economic barrier, which has not yet been surmounted and which continues to separate dentistry, educationally, from medicine. How to overcome this barrier is still one of the unsolved problems of professional education.

IV. DISCOVERY OF ANESTHESIA

The next forward step in the evolution of dentistry in this country was the discovery, in 1844, of surgical anesthesia by Horace Wells, of Hartford, Conn. Two years earlier, Crawford W. Long had made use of ether in surgery, and two years later, in 1846, William T. G. Morton, of Boston, demonstrated the use of ether as an anesthetic before the Massachusetts General Hospital. Horace Wells, however, was unquestionably the first to recognize and make known to the scientific world the principles of anesthesia. In this, he was unique. Long's use of ether as an anesthetic in 1842 seems to have been more or less accidental. He made no attempt to make its use known, and knowledge of its possibilities as an anesthetic did not extend beyond the boundaries of the small town in Georgia where he practiced medicine and carried on the business of town druggist. Morton, who at one time had been a pupil of Wells and doubtless was familiar with Wells' experiments in the field of anesthesia, was the first to make known the anesthetic properties of sulfuric ether,

and for this he has been elected to the Hall of Fame.

Since Wells was the first to recognize and proclaim the principles of anesthesia, to him, as to no other individual, belongs the title of Discoverer. Others before and after him have laid claim to that title; one, who was, as we have seen, the first to employ an anesthetic, but with no realization of its possibilities; another, because of his use and public demonstration of ether anesthesia two years later, both doubtless inspired by the knowledge of Wells' experiments. Credit should be given to all who in any way contributed to making possible this greatest of life's blessings; but to only one man can be given the title of Discoverer and Revealer of Surgical Anesthesia. That man is Horace Wells.

Dentistry as a separately organized profession has done much to make the world a better place in which to live; has made substantial contributions to the prevention and relief of human suffering; has seen facial deformity and ill health give way before the science and art of its own creation, having meanwhile transformed an occupation for livelihood into a learned profession. But in none of these achievements is dentistry's contribution to human welfare comparable in importance to that made by the discovery of surgical anesthesia. In this, Horace Wells, a pioneer dentist, has placed all mankind in his debt. His claim to recognition is being considered at this time by the College of Electors of the New York University Hall of Fame.

V. NEED OF A WIDER DISTRIBUTION OF DENTAL CARE

But again, it is not of these things, important and interesting though they be, that I wish to speak, not of the past, but of the present, not of what has been accomplished, but of what remains to be done. While this centennial celebration provides for the profession an occasion for self-congratulation, it should also be made an occasion for professional self-examination. There can be little purpose in reviewing the past, unless in doing so we find an incentive to renewed effort in the present. As we review that past and consider the responsibilities of the present, we shall find that only a beginning has been made. The goal is not yet in sight. All about us are unfinished tasks and unsolved problems.

First and foremost among the problems awaiting solution is that of the millions of people in this country who are not receiving the dental care essential to their health. This situation is due partly to the prevalence of dental disease, and partly to ignorance of the public regarding the importance of dental care. Both, in a way, are responsibilities of the dental profession. Dentistry cannot be said to have discharged its duty to society when more than half of the people of this country receive little or no dental care. The next forward step is to bring such care within the reach of all, rich and poor alike. This, it seems to me, transcends in importance any task at present confronting the dental profession. Not "Dental Health for American Youth," but "Dental Health for the American People" must be our objective as well as our slogan. Ours is a gigantic task and one that may, on first thought, seem impossible of completion. But where there's a will, there's a way. To find the way is the next step forward and dentistry's most pressing problem.

VI. RESEARCH

Obviously, the first move must be in the direction of research. Some way must be found to uncover the hidden causes of dental diseases before any substantial progress can be made toward their control. It is no more possible to solve the problem of dental health for the American people by present-day methods of practice than to try to fill a bucket with water when the bottom is out. In both

instances, the problem is being attacked at the wrong end. "When God created man," it is said, "He gave him two ends, one to think with, and the other to sit on. Man's future" (and it may be said his success in any enterprise) "is dependent on which end he uses most. Heads, he wins; tails, he loses."

The need for research is clearly recognized by the American Dental Association, which has already expended more than half a million dollars of its own funds with a view to the prevention and limitation of dental disease. The problem, however, is too large to be solved by any one group among our citizens. Moreover, since all research of this nature is undertaken in the interest of the public, it is the public who should be expected to pay the cost. A first step in that direction was the introduction into the United States Senate of a bill to provide funds for such research. In presenting this bill, Senator Murray has not only made friends of the members of the dental profession, who are grateful to him for his cooperation, but has also placed the public in his debt. To him, I extend the thanks and appreciation of the American Dental Association. Through its efforts and those of the National Health Program Committee, with the cooperation of the Research Commission, Senator Murray's support was enlisted. This is a move in the right direction. In the interest of the public, it should be continued until the present almost universal condition of dental disease no longer exists. If anything were needed to emphasize the importance of this, it would be found in the results of an examination recently made showing that more than 30 per cent of the 12,000,000 men to be called for military training between the ages of 21 and 31 will probably be disqualified because of dental defects. This means nearly 4,000,000 men; and if it is true of men in this age group, what must be the condition of those of our citizens who are older?

VII. LAY EDUCATION

Among those not now receiving adequate dental care are millions whose failure to do so is due to ignorance of their need. These must be reached through education. This again is a situation recognized by the American Dental Association in setting up its Bureau of Public Relations. The work now being done by the Bureau needs to be extended and continued in the interest of the public. Thus, countless people could be reached and, largely at their own expense, be given care, which they now lack. In this, the profession should take the lead, meanwhile soliciting the cooperation of every health agency in the country. To a considerable extent, cooperation is already being given. Surgeon-General Parran, of the United States Public Health Service, has been especially cooperative in this connection.

VIII. CARE OF THE INDIGENT

While research and education are manifestly of first importance in any program to provide dental health for the American people, they offer only partial solutions to our problem. They do not make provision for the immediate care of those who are already suffering from the cumulative effects of long years of dental neglect. This is a situation which can be met only by treatment, which should be limited to the indigent, with especial attention to the preschool child. This part of the program is clearly the responsibility of the state. It is no more the duty of the dental and medical professions to care for those in this class than that of any other group of citizens. They should, however, take the lead and cooperate to the full extent of their resources. This they have both shown a willingness to do.

Research, education and care of the indigent by the state make up the three-point program set up by the American Dental Association in its efforts to provide for a wider distribution of dental

health service for those whose need no one disputes. This is the only logical approach to a problem which, at some time in life, touches every man, woman and child in this country. It represents one of the major health issues of this generation and is so regarded by many thoughtful persons concerned with the health of the nation. A Harvard committee referred to it recently as "one of the great public health problems of the future."

IX. DENTAL EDUCATION

There remains another problem confronting the profession to which no allusion has been made, partly because I do not know the answer and partly because of its controversial nature. My faith, however, in the composite judgment of the profession encourages me to speak of it and makes me confident of its ultimate solution in the interest of all concerned. I refer to dental education.

A hundred years have elapsed since that first dental school graduated its students after a course of only four months. Many improvements have been made since then. Instead of no preliminary educational requirements as in 1840, not less than two years of college work in the sciences is now required for admission to any dental school in this country. Four years instead of four months must be spent in undergraduate study. Prodigious strides have been made to keep abreast of the growing responsibilities of dental practice, responsibilities which are still increasing. Whether the advances so made have kept pace with the educational needs of the profession is a question about which there seems to be no unanimity of opinion.

There are many thoughtful persons, especially in the field of education, who believe that a serious mistake was made when, in 1840, dentistry separated itself educationally from medicine. So thoroughly convinced are they of this that some are willing to spend millions of dollars in an effort to educate the dentist along the lines of general medicine, superimposing on such a course of instruction training in the technical procedures of clinical dentistry.

There are those, again, even among educators and physicians, who feel that this is unwise, that the same objective could be achieved, with better results for all concerned, within the present system of dental education. It is the opinion too of those holding to this belief that it is economically impossible to spend five or more years in the study of dentistry, when the cost of education and the rewards of practice are out of proportion to those of other professions. They are doubtful, moreover, whether the student so trained would serve the public as competently as under present-day methods of education, with, of course, the added improvements that are constantly being made. Such is the situation at present.

Our attitude as a profession toward this most important problem (one that stands at the very threshold of professional progress) should, it seems to me, be one of open-mindedness. If, by such a plan as that referred to above, the dental profession can be trained to give a service more acceptable than that now being given, including cost, distribution and quality of service, we should welcome the change. If, on the other hand, experience should prove that this is not true, that the dentist so trained is less competent to meet the needs of the public, all things considered, the educational system now in operation should be continued. It is only by the old and familiar rule of trial and error that their respective merits can be determined.

As we review the problem thus presented and note the diversity of opinion regarding its solution, there seems to be but one thing about which all will agree; namely, that the dental practitioner of the future must be so educated that the biologic background of daily practice will be of as much concern to him

as are its more obvious technical procedures.

It is generally agreed that diseases affecting the oral cavity cannot be separated from those of the body as a whole; nor can they be successfully controlled, in many instances, by purely local measures. Whether the dental practitioner educated to meet this newer conception of practice shall be given a medical or a dental degree, or both, would seem to be a matter of less importance than that he be fitted to meet effectively the increasing responsibilities of daily practice. This he must do; and if dentistry should thus become an accredited specialty of medicine, well and good. The essential thing is that it shall prepare itself to render more and more efficiently a service which cannot at present be performed by any other health agency.

X. CONCLUSION

This, briefly, is the story of American dentistry, its achievements in the past, its hopes and plans for the future. For a hundred years, it has ministered to the needs of mankind. During those years, it has had as its objective the prevention and relief of human suffering, the very antithesis of the savagery and brutality now ravaging the world. To that end, it has made notable contributions in the past. To the same end, it rededicates itself, as it stands, confident and unafraid, on the threshold of another century. Its part in making the world a healthier and happier place in which to live will continue in spite of the madness of war. Man's inhumanity to man may prevail for a season, but the instinct for righteousness and the deeply rooted belief in the brotherhood of man must triumph in the end.

THE BACTERIOLOGIC STATUS OF THE DENTIN AFTER CAVITY PREPARATION

By SAMUEL SELTZER, D.D.S., Philadelphia, Pa.

ALTHOUGH the dental profession has known that bacteria are present in carious dentin, no effort has, to my knowledge, been made to ascertain whether these bacteria can be removed mechanically by proper cavity preparation. This report is the result of an attempt to find an answer to this question.

PROCEDURE

Patients were selected at random, varying in age from 6 to 17 years. The work was confined to occlusal cavities since these could be sealed more easily and with more assurance that the temporary cement would not break out under mastication. All teeth under observation were placed under the rubber dam. The teeth and the adjacent dam were painted with tincture of iodine followed by alcohol and chloroform. Thereafter, every instrument or bur introduced into the

TABULATION OF RESULTS

Cases	Type of Cavity		
	Shallow	Medium	Deep
Cultured	72	113	49
Positive	30	95	46
Negative	42	18	3
Per Cent Positive	41.6	84.0	93.8
Per Cent Negative	58.4	16.0	6.2

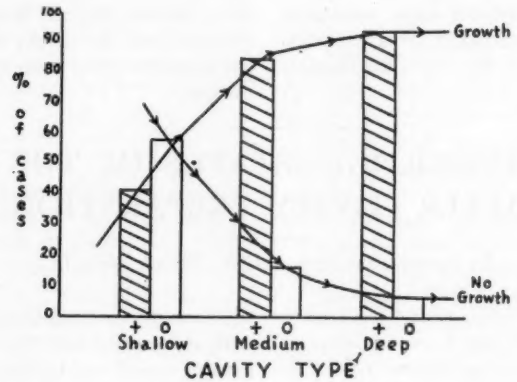
Work done at the Children's Dental Clinic of the Philadelphia Mouth Hygiene Association.

Read before the Academy of Stomatology, Philadelphia, Pa., September 26, 1939.

cavity had been dipped into a molten metal sterilizer and allowed to remain for twenty seconds. Appleton[1] has shown that this procedure will sterilize an instrument.

The cavity was then prepared and all carious material removed with a sharp sterile excavator. The cavity was prepared exactly as it would be for a metallic restoration. As soon as it was believed that the cavity was ready for filling, but prior to the introduction of any medicament, shavings from the dentin at the floor of the cavity were immediately inoculated into a tube of Rosenow's brain broth, an excellent medium for the growth of streptococci and lactobacilli and having the additional advantage of growing both aerobes and anaerobes in the same tube.[2] All cultures were incubated for from seventy-two to ninety-six hours and then examined microscopically. Since this study was not concerned with the bacteriology of dental caries, it was deemed necessary to record only the presence or absence of bacteria.

The cavities were grouped under three general headings: (1) shallow, (2) medium and (3) deep. By shallow, I mean that type of cavity in which an explorer will just catch and the dentin has not yet been involved to any great extent roentgenographically (defective pits and fissures in the majority of cases). Medium cavities were those in which the dentin was already involved by the carious process, but in which there was still a layer of healthy dentin between the floor of the cavity (after preparation) and the pulp. In these cases, indications of caries could be seen in the dentin roentgenographically. In the deep group were placed those cavities in which little dentin remained after the cavity preparation and also those in which there was a possibility of pulp involvement. In none of these cases could the dentin at the floor of the cavity be classified as healthy.



CONCLUSIONS

1. The chances for mechanically eliminating all bacteria from a shallow cavity are greater than 50 per cent.

2. Once the bacteria get into the dentin, the chances for eliminating them by proper cavity preparation become progressively less the larger the cavity.

3. Bacteriologic studies are convincing evidence that cavities should be opened and properly filled as soon as they are detected.

4. In deep cavities, the inability to remove all bacteria merely by careful excavation emphasizes the necessity for

sterilization of the dentin prior to introduction of the filling material.

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5412 Berks Street.

HAS IT BEEN PROVED THAT SUGAR IS A SIGNIFICANT FACTOR IN DENTAL CARIES?

By FLORENCE B. HOPKINS, M.D., D.M.D., Boston, Mass.

THERE are many important factors in dental health. The dentist should, whenever possible, advise his patients regarding them. A partial list of these factors includes heredity, environment, the general health, hygiene and nutrition. Nutrition must be subdivided on the basis of the character of food, the quality and quantity of food, the digestive processes and metabolism, the last a complex subject.

Those of us whose primary task is to teach dental health must endeavor to interpret for the people we serve the results of all the best and latest research work on dental caries. We must evaluate all the material that we can acquire and then dispense advice that will be not only sound, but also practical and usable. One needs much scientific training, much practical experience and nothing less than the judgment of Solomon to cope with this task. We study diligently the reports of this research worker and that one. We are well satisfied with the ability, honesty and scientific training of all of these workers. We can pick few, if any, flaws in their procedures or their thinking; yet they do not agree with each other. What then are we to teach?

Some workers claim that elimination of sugar from the diet reduces or entirely arrests caries.[1] Others have shown an improvement in the dental condition with an increase in the vitamin C intake.[2] Still others have stressed the importance of vitamin D in caries prevention.

Research on the influence of sugar as a factor in dental caries has had a great revival. Nina Simmonds gave a most instructive review of these activities in a paper read before the Food and Nutrition Section of the American Public Health Association at Kansas City last October. All dentists interested in this subject should read this review carefully.[3]

Most of the studies made on children to determine the relation of dietary factors have been carried on in institutions. A study of some of this work reveals that "in one of the orphanages the diet of the children was admittedly below the standards accepted as normal for children as regards protein, calcium, phosphorus and vitamins and yet during this time these children had a very low incidence of tooth decay."[4]

How much the nervous, mental or emotional state affects nutrition and health in general, we do not know. It is no doubt a factor that we cannot wholly overlook. The child in the institution is

From the Division of Child Hygiene, Massachusetts Department of Public Health.

Read before the Section on Children's Dentistry and Oral Hygiene at the Eighty-First Annual Session of the American Dental Association, Milwaukee, Wis., July 18, 1939.

frequently leading a less disturbed and better regulated life than the child who must share the adult regime and the disturbances and irregularities of ordinary family affairs.

Several studies relating to the cause of dental caries have been carried on in outpatient departments or private practice on children living in average homes. A report of one study made at Forsyth Dental Infirmary stated in summary:

> In the preliminary findings of a study of 132 patients followed for dietary supervision over a period of 1.6 years, an average reduction of dental caries of 79.21 per cent was observed in 104 cooperative patients. In 28 noncooperative patients, an average increase in dental caries of 12.97 per cent occurred. This increase compares with the expectancy for the average age of the group studied, which was 6 years."[5]

In this study, the following daily diet was considered optimal for dental health: 1 quart (946 cc.) of milk; one raw vegetable (or canned tomato), with special emphasis on cabbage and tomato; at least two cooked vegetables, one of which may be potato; two servings of fruit, with special emphasis on oranges; one egg; meat or fish five times a week, and butter on vegetables and bread. An attempt was made to keep cereals and breads, because of their acid ash, as low as was consistent with the requirements for energy. Candy was allowed only at the end of the meal. Cod-liver oil was not given routinely, but was prescribed by the pediatrician in occasional cases.[5]

Another study was that of E. H. Schiotz, who was instrumental in establishing the famous Oslo breakfast for school children. He made a careful study of the 200 children in the national schools who had healthy teeth. He investigated the character of feeding from birth, the dietaries of the mothers during pregnancy, the economic status of the parents and the present height and weight of the children. He also studied the dietaries and teeth of the children in the twenty-three homes where accurate data were kept. He found that the social and economic status of the family plays an important part, well-to-do children having 13.5 times as good a chance as children from poor homes to have healthy teeth. The health of the teeth appeared to be proportional to the regular supply of protective foods. He found no established correlation between the consumption of sugar and the health of teeth in different institutions; whereas the regular supply of cod-liver oil in winter seemed to play a beneficial part.[6]

B. R. East showed that the more remote the season is from summer, the greater the caries incidence, the three winter months producing the greatest number of cases.[6]

On the Island of Tristan da Cunha, it has recently been reported[7] that the sugar consumption has lately been approximately 5 to 10 pounds per capita per year as compared with more than 100 pounds in the U.S.A. Although the diet is rather below our standard requirements, the general and dental health is remarkable. There is, however, one group of the inhabitants which differs in respect to the type and incidence of dental caries; namely, the mothers. While the decay, as a rule, is of a superficial character, affecting few teeth, most of the mothers have one or more teeth with extensive caries, which seems associated with the number of pregnancies. The small amount of sugar is divided fairly equally among all members of the community. Obviously, there are some other factors in the progress of dental caries in some of the individuals. This little island is situated in the South Atlantic, midway between the tip of Africa and South America. The isolation of this settlement not only curtails its supply of foodstuffs, but also makes for little or no strain from marital, social, financial or political upheavals such as continuously affect a large part of the population of the United States. The whole habit of life

may account for the parallelism with the institutions before mentioned as regards good teeth on a low standard diet.

A few years ago, Percy R. Howe fed a group of monkeys quantities of sugar in the form of large sticky caramel-like masses. This practice he continued for nine months. During this time, the teeth were not cleaned and the monkeys were fed a well-balanced adequate diet, which they consumed with no apparent loss of appetite. At the end of the experiment, the teeth were cleaned and carefully examined. Caries had not been produced. If a similar experiment were to be tried on human beings, the time of feeding the sugar would have to be carefully planned. Unlike the monkeys, our children, who are allowed sweets at any or all times, do not have appetites left for the foods supplying other necessary nutritional elements.

In commenting on the results of a study soon to be published by the Forsyth Dental Infirmary, Ruth White makes this very apt statement:

> The between meal consumption of sweets and adhesive carbohydrates is intimately associated with the whole field of home management and child guidance. Parents who provide carefully planned meals at regular intervals seldom allow indiscriminate between meal lunches. Conversely, regimes which permit the child to eat whatever he wishes whenever he is hungry usually involve "hand to mouth" management of the entire dietary with little regard for healthful foods.

Dr. Bundesen says that the body chemistry of a growing active child is such that he sometimes needs the readily available energy furnished by eating sweets; candy can have a proper place in the diet, as long as it does not replace the essential food substances that the child must have to be healthy, and the belief that sugar causes tooth decay has not been sustained by research work done on that subject. But the abuse of sugar if it is allowed to take the place of phosphorus, calcium and vitamin-containing foods believed to be essential to teeth may very well contribute to tooth decay.[8]

SUMMARY

1. A certain amount of sugar may be needed in the dietary.

2. Food habits of the nation, encouraged by advertising propaganda, make omission of the use of sugar impossible.

3. Good dental health and good general health are dependent on good nutrition. This involves not only eating habits, but also healthful living.

4. We do not know the cause of dental caries. Many conditions are responsible for its frequency.

5. That sugar is a significant factor in dental caries is a proved and accepted fact. Theories as to its action are still unproved. The consumption of sugar cannot as yet be identified as the real cause of dental caries.

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THE RECALL SYSTEM

By Floyde Eddy Hogeboom, D.D.S., Los Angeles, Calif.

IT has been demonstrated by clinical experience that the best preventive dentistry results from a satisfactory regulation of patients by some form of recall system. Each recall system must be worked out to fit the peculiar needs of the individual office. A system that is successful in one dental office may not work in another, but there are certain fundamentals that are worthy of study.

In our office, where the main emphasis is on preventive dentistry by early care and systematic observation of children, we have found through the years that the only practical way of conducting a dental practice involves a recall system. The two principal means used are the telephone and the printed card mailed to the home. Some dentists depend, to a great degree, on the telephone for recall of their patients. It is my opinion that, in the majority of cases, unless a request is made by the patients themselves, a suggestion by telephone that a patient make an appointment is ill-advised. Frequently, the telephone rings at a time when the mother is busy and has many irritating and upsetting things to contend with. Against her will, she may be maneuvered into making an appointment for the child and, when the time comes, the appointment is either ignored or postponed. For these reasons, I prefer the use of a printed card, stating that it has been several months since the patient was last seen and requesting that the mother call at her convenience for an appointment. These cards are mailed out the first of the month.

The frequency with which the patient should be recalled must be determined by the condition of the mouth. In our office, we believe that a child should be seen at least three times a year. We explain to the mother, or parents, what we are attempting to do, stating that, if there is no objection, we will put the child on our recall list and mail a card to them at the proper time. We have found that this meets with the hearty approval of nearly every patient. However, if the parents request that we telephone them, we carefully make a note to that effect.

The efficiency of this system is based upon the master schedule book. This book is divided alphabetically, and ruled so that each month of the year is represented by a column. When the work is completed, a circle is placed opposite the name and under the month when the operations were completed. In the column representing four months later, a dash is made. When the time has elapsed, the secretary sends a card to the patient telling him that a period of four months has elapsed, and requesting him to make an early appointment. A cross is placed over the dash in the master schedule book to indicate that the card has been mailed out. If no reply is received during the current month, another card is mailed out the succeeding month. After a period of from six months to a year, if no reply is received from a series of cards, the name is scratched off the list. This does not necessarily mean that the patients who did not reply are lost to

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the office. We find frequently that after an extended lapse of time, many patients will again call for an appointment. For many reasons, people find it impossible to keep up with a schedule as outlined to them, or they may wait until they are forced to come in. Of course, this is the very thing that we try to prevent by the recall system. After studying various cards, we selected the following wording as best for our purpose.

Dear_____You are reminded that it is_____months since your last visit. In justice to yourself and the services rendered, you are requested to call for an appointment at your earliest convenience. Our number is _____. Thank you.

We have been using this method of recall for about nineteen years, and the results have been very satisfactory. In a large city, where people move frequently, and under the existing economic disorder, we must accept the loss of a certain percentage of patients as due to conditions over which we have no control. The reasons for loss of patients, which are many, do not enter into the subject matter of this paper.

Taking the year of 1938 as an example, we find, in going through the list of patients in alphabetical order, that about 73 to 75 per cent of the cards sent out brought requests for appointments. Of the 25 per cent of patients from whom no answer was received, all are not lost, as I have said, but have simply not cooperated in this method of systematic monthly supervision.

In a recall system, there should also be a thank you card, to be mailed out to those who refer patients. The recall card is often a means of stimulating old patients to refer new patients, and consequently referring patients should be informed when new patients give their names in reference.

Successful management of a dental office depends on the complete cooperation of every member of the staff. The dentist may be a fine operator, but unless people come in to be operated upon, his training and experience are wasted. So he must build around him an efficient secretary and assistant organization. It is the secretary's duty to see that the business office is properly administered, and that there is a constant flow of patients through the office. Thus, in the final analysis, the success of the recall system depends largely on the office secretary and her method of handling it. I think that every office should have a recall system, a system that works. It may mean the difference between profit and loss, a successful and enjoyable practice or a run-down and worrisome practice.

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THE NATIONAL BOARD OF DENTAL EXAMINERS

THE question of the reciprocal dental licensure has been under almost continuous discussion in dentistry in one form or another for forty years.

As early as 1901, R. R. Andrews, of Boston, in his address as chairman of the Section on Stomatology of the American Medical Association, emphasized the desirability of some modification of the dental laws for licensure to practice that would enable the dental practitioner to transfer his activities from one state to another without being subjected to reexamination. The need for such a provision increased through the years until the way was opened for all states to enjoy these benefits through the association and affiliation of the examining boards of the various states with the now well-established National Board of Dental Examiners.

To present a brief historical background of the evolution of the movement: Charles S. Stockton, of Newark, N. J., in 1902, only a year after Dr. Andrews' suggestion, presented at the Asheville meeting of the National Association of Dental Examiners a resolution, which has since become known among the dental examiners as the "Asheville Resolu-

tion," recommending that a plan for interchange of licensure be adopted by the various boards. The resolution in question read:

> Resolved, that an interchange of license to practice dentistry be and is hereby recommended to be granted by the various state boards, on the following specific conditions:
>
> Any dentist who has been in legal practice for five years or more, and is of good moral character, and who is desirous of making a change of residence into another state, may apply to the examining board of the state in which he resides for a new certificate, and said certificate, if granted, shall be deposited with the examining board of the state in which he proposes to reside, and the said board, in exchange therefor, may grant him a license.

Later, this resolution was amended by adding the provision that the candidate receiving the certificate must have been in practice for five years in one place and in the state in which he practiced must be a member of the state or the local society.

After the passing of this resolution, a number of state boards adopted the plan, and reciprocity became an established fact. It became necessary, however, because of the variation in requirements of the several states, to provide some standard of equality in this respect, and efforts were made to overcome this difficulty by agreement between individual states. In 1903, New York and Pennsylvania adopted a reciprocal agreement. In 1905, New York, New Jersey and Pennsylvania adopted an agreement providing for exchange of license among the three states, and numerous other states entered into similar agreements.

By the year 1912, the plan had grown to sizable proportions, but the requirements of the boards were so varied that many state boards refused to agree to reciprocity. Thereupon, the plan lost favor, and it was almost completely abandoned. However, in 1926, a new interpretation of the idea resulted in the formation, under the sponsorship of the American Dental Association, of the National Board of Dental Examiners, which, after a rather checkered existence of fourteen years, now emerges with the promise of a most useful career. This new interpretation of reciprocal licensure comprehended a general examination that would qualify the successful candidate for licensure in any and all states participating in the projected plan. Immediately, a number of states subscribed to the plan, but certain states, or rather certain examining boards, apparently apprehensive of infringement upon their prerogatives, failed to support the movement and, a few years ago, the National Board of Examiners as a body withdrew from participation in the plan.

Now, we are happy to report, the differences of the several participat-

ing bodies have been ironed out. The examiners have returned to the fold and have declared their intention to support the plan. We, therefore, look forward to a wider acceptance of the idea and a broadening of the sphere of influence of the board, with extension of the reciprocal benefits to a much larger number of the profession.

Under the plan proposed by the National Board, the American Dental Association agreed to finance the project, which was to be participated in by the three national bodies most vitally concerned: the American Dental Association; the National Association of Dental Teachers, and the National Association of Dental Examiners, with representatives of the Surgeon General of the Army, of the Navy and of the Public Health Service. Participation of individual states was entirely optional, and the sphere of influence of the National Board broadened to include fourteen states with a promising future, until the withdrawal of the National Association of Dental Examiners.

The basic principle upon which the National Board is founded and which justifies its existence and continued support is in essence the same as that upon which the state board and the state licensing laws are based; namely, that there should be a standard of qualification for dental practice to which the education of every graduate should conform and that this standard of qualification should be determined by a national board.

We believe that every member of every state board subscribes to this principle as the one upon which dental licensure in general should rest, but there are sectional educational and professional particulars that should be left for determination by the individual state boards. Thus it is that the National Board has left entirely in the hands of the state board the determination of the technical qualifications of the candidate, so that the board, as it now interprets its function, is in effect a certifying body which places its stamp of approval upon the qualifications of the candidate for license in the individual state after specific local requirements have been met.

The enabling act creating the National Board as adopted by the House of Delegates specified that the purposes and duties of the National Board "shall be to provide for the admission of qualified persons to the practice of dentistry in any state, territory or dependency of the United States without further examination by licensing boards thereof, except as required by the laws of various states." In short, the purpose of the National Board is not to displace but to cooperate with the various

state boards in establishing the most efficient test for determining the fitness of applicants to practice dentistry and to make the test of such high character as to merit recognition by the various state boards.

No board in any state will be compelled to accept the findings of the National Board. The board merely certifies the applicant's ability to practice dentistry. The inherent rights of the individual states are in no manner infringed on, nor are the powers of the state boards superseded, as each board, at its discretion, may require a special examination in any individual case.

That this board performs an important educational function is apparent in the part that it plays in maintaining high educational standards, and in this rôle it can do much toward the attainment of the educational objectives of the new Council on Dental Education.

The National Board has thus far examined and certified nearly five hundred candidates, and these men, in the event that a change of location becomes necessary, can continue in practice by submitting themselves to an examination in clinical practice by the dental board of the state in which they wish to practice. Almost an equal number have failed of certification, which indicates that the National Board will not be the means of encouraging itinerant and migratory dental practice.

We are convinced that this activity deserves the whole-hearted support of all educational groups of the profession; and that the profession owes a debt of gratitude to all those who have served on the board, and particularly to its present chairman and its secretary, Harold W. Alden and Morton J. Loeb, for their earnest and constant efforts in support of this instrumentality for maintaining high standards of dental practice as a public health measure.

No one can foresee when a combination of circumstances may make it desirable, even necessary, to change his location, and to be compelled to undergo an examination in the elemental studies is, to say the least, most discouraging. Dentistry certainly should have the same standards in every state in the Union, and the methods of determining one's fitness for practice should have some semblance of uniformity. It is manifestly a travesty on justice that a man, although qualified to practice in one state, and having attained a high degree of skill and efficiency and a high professional standing, is not permitted to practice his profession in other states without passing an examination primarily intended to test the capabilities of the recent graduate.

The American Dental Association has seriously interested itself in the educational efforts of dentistry in the sponsoring of an educational council, among whose duties will be that of establishing a more uniform course of study for all schools, and the National Board is another agency that can and will, we predict, aid materially in the attainment of this objective of uniformity in educational standards.

DENTAL PREPAREDNESS

IN December 1939, Arthur H. Merritt, President of the American Dental Association, appointed the following members of the Association to serve as the Committee on National Defense; this action being taken at the request of Brigadier General Leigh C. Fairbank, chief of the Dental Corps of the U. S. Army: Clarence G. Brooks, New London, Conn.; Edward H. Bruening, Omaha, Nebr.; H. O. Lineberger, Raleigh, N. C.; John T. O'Rourke, Louisville, Ky.; J. Ben Robinson, Baltimore, Md.; Leuman M. Waugh, New York, N. Y., and C. Willard Camalier, Washington, D. C., chairman. Later, Gerald D. Timmons, Executive Secretary of the American Dental Association, Chicago, Ill., was made secretary of the committee.

The committee was appointed to cooperate with the governmental agencies in a general program of national defense. At the Annual Meeting of the American Dental Association in Cleveland, the name was changed to the Dental Preparedness Committee, and the committee was directed to proceed in its purpose of cooperating with the governmental agencies in relating dental service to the needs of the Army and Navy under the recent Conscription Act. The committee was instructed by the Board of Trustees of the American Dental Association to obtain information from the members of the profession that would enable the Association to so apportion the services of the profession as to meet the needs of the Army and Navy for dental service and enable the profession to render necessary assistance in preparing the new recruit for army service. This was to be done without interfering with the dental service to the public and, at the same time, the interests of the profession were not to be overlooked.

The committee presented its report to the House of Delegates at Cleveland, and the report was referred to a special reference committee. The Reference Committee enthusiastically approved the report and made the following recommendations:

(1) That a questionnaire be authorized and distributed as promptly as possible to all registered dentists in the United States and its possessions, designed to obtain military information and data of value to the Association.

(2) That these questionnaires be classified and the information be tabulated and made available, as promptly as possible, in order that the military officials in Washington and members of the National Defense Committee may consider them promptly.

(3) Inasmuch as the Surgeons General of the Army and Navy have officially requested the American Dental Association to give some assistance in the matter of reducing the percentage of rejections for dental defects as applied to volunteers and prospective draftees, under the proposed conscription law, the committee recommends that proper officials of the American Dental Association discuss this matter further with federal officers in Washington, in an attempt to reach a satisfactory agreement as to the best method of procedure; and when satisfactory arrangements are concluded in this respect, information along this line be transmitted to the profession, and the Military Affairs Committees of states, for their guidance and assistance in any plan which may be adopted.

(4) That the courses in military dentistry now being prepared by the War Department be endorsed, as it is felt that this material will be an extremely valuable contribution to the proposed program; and that these courses be published for the information of the members of the American Dental Association and the use of our state military affairs committees and study clubs.

(5) That the House of Delegates go on record as approving in principle the preparedness program of the United States, and offering the full cooperation of the Association in these efforts.

The purpose of the Association in gathering information from these questionnaires is to aid the government in the proper apportionment of dental services. If an emergency arises, it is the desire of the United States Government to assign every dentist capable of service to that position in which he can best serve his country, and it is hoped that the data contained in these questionnaires will enable the government to accomplish this purpose.

Another plan which the American Dental Association has in mind for use of the information that will be contained in the questionnaire is the publication in the near future of a dental directory of the United States and its possessions. It is, therefore, urgent that every dentist furnish full information whether or not he is within the age limits of conscription.

The questionnaire has already been sent from American Dental Association headquarters to every member of the profession whose address could be procured, and every one is urged to answer the questions fully and to return the questionnaire at once.

It is particularly desirable to indicate whether you will volunteer for military service. This is quite important for the dental profession, as the

dental corps must check and investigate the qualifications of those volunteering. It is important too in that lack of volunteers may compel the drafting of men whose absence on active duty may work a severe hardship on the community.

The dentist applying for reserve commissions must present evidence of graduation from a recognized dental school. He must be under 36 years of age. He must present evidence of his present professional activity; that is, that he is actually in the practice of dentistry.

There are many dentists not in active practice who may be desirous of enlisting in the Reserve Corps, but the government is looking for more than just men who hold degrees. They want men who are actually qualified to render dental service of a very exacting nature for the Army and Navy personnel.

Each candidate for a commission in the Dental Reserve Corps must present statements from several physicians and dentists recommending him for appointment. He must pass a physical examination which is very rigid.

While membership in the American Dental Association is not essential, it can be expected that boards will not have much confidence in a man's professional ability if he does not have sufficient regard for his professional standing to belong to the recognized dental organization. This is not to be construed as an effort to compel alinement with organized dentistry as such, but rather as a protective measurement in the selection of personnel to render dental service for our nation's Army. Those who defend our nation deserve our nation's best.

As a help in carrying out its purpose, the committee has appointed state military affairs committees, the personnel of which is published on another page of the present issue for the information of all dentists who are concerned in the preparedness effort.

The preliminary steps that have already been made by the Committee on Preparedness would seem to insure us against repeating some of the disastrous mistakes of the World War, when many young dentists were drafted into regular military service rather than being enlisted in the Army and Navy Dental Corps. As an added precaution against such an eventuality, the younger dentists in the draft ages can volunteer or apply for assignment in the service of the Army and Navy Corps.

However, the profession, through the committee, faces its obligations with confidence and with the belief that it can be of material aid to the government in rendering a health service of great benefit to the defensive forces of the nation.

This occasion affords an unusual opportunity for the American Dental Association to discharge some of its obligations to the members of the profession, as well as an equal opportunity for dentistry to fulfil some of its obligations to the nation.

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By WILHELM PRODINGER. Translated and amended from the second German edition by STEWART HOHNES. Cloth. 203 pages. Price $5.00. Elsevin Publishing Co., Inc., Distributor; Nordenman Publishing, Inc.

This is a technical book of primary interest to analytical chemists, but also of fundamental importance to all chemists. Its main interest to the dentist lies in the fact that it is a compilation of facts, principles and procedures which mark a distinct advance in a science essential to the medical sciences. The original German version of this book was the first of its kind in the field. The information made readily available in the English translation will be of value to those who are interested in determining the composition of various materials and medicinals used by the dental profession.

Oral Surgery

By STERLING V. MEAD, D.D.S., M.S., B.S. Second edition. Cloth. 1315 pages with 553 illustrations. Price $12.50. St. Louis: The C. V. Mosby Company, 1940.

This large book, which deals with the surgery of the teeth and jaws, should be of interest to exodontists and oral surgeons. In the first sections, the author takes up methods of oral diagnosis, anatomic relations fundamental to operative surgery in the mouth, preoperative preparation of the patient, selection of anesthesia and surgical technic. The latter portions of the book deal with specific problems and their treatment. Herein, one finds an adequate discussion of the methods of removing impacted teeth, the surgery of jaw cysts, the surgical treatment of periodontal disease and the treatment of fractures of the jaws and a discussion of oral neoplasms. A chapter on harelip and cleft-plate surgery by Federspiel has been included. Although there is so much of value in this book, the author is verbose, quoting from so many sources verbatim that it is difficult to read through any section of the book. The colored plates are poor and contribute little. The line drawings are very nicely done and together with the x-ray pictures, which are profuse, add greatly to the clarity of the text. A bibliography follows each chapter in a commendable effort on the part of the author toward completeness in his work, but because many references are incorrectly quoted, it is evident that this feature will add considerable confusion to those using this work as a textbook.

Synopsis of the Principles of Surgery

By JACOB K. BERMAN, A.B., M.D., F.A.C.S. Assistant Professor of Surgery, Indiana University, School of Medicine. Cloth. 615 pp. with 274 illustrations. Price $5.00. The C. V. Mosby Company, St. Louis, 1940.

In this excellent short textbook on surgery, emphasis has been placed on the basic sciences and their application to an understanding of clinical problems. Throughout the text, frequent reference is made to underlying physiologic or anatomic principles which affect the treatment of the disease under discussion. The first one-third of the book is concerned with such pertinent subjects as shock, acid-base balance, the interchange of body fluids and repair. The latter

portion of the book contains a description of the surgical diseases of the body considered by regions, with discussions of the diagnosis and treatment. There is a section of five pages on diseases of the mouth and jaws. This book should be useful to those wishing a short survey of the field of surgery or as a textbook to be supplemented by more adequate discussions of diagnosis and treatment. The volume is nicely bound, of a convenient pocket size and printed on good paper with easily read type.

The Era-Key to U.S.P. XI and N.F. VI

Revised by LYMAN D. FONDA, Professor of Pharmacy, Brooklyn College of Pharmacy, Long Island University. Cloth. 320 pages. Newark: The Haynes & George Co. Price $1.00.

This pocket-size book contains in abbreviated form much of the essential information in the current editions of the U. S. Pharmacopoeia and the National Formulary. In addition, it contains a glossary of medical terms, a pharmaceutic Latin dictionary, a table of doses, a section on incompatibilities and a key to non-official materia medica. The compilation of non-official materia medica is of necessity too brief to add much to the value of the book. The book will be of interest to those who desire condensed, pertinent information concerning official drugs and preparations.

Crown and Bridge Prosthesis

By STANLEY D. TYLMAN, A.B., D.D.S., M.S., F.A.C.D., Professor of Prosthetics, Head of the Department of Fixed Partial Dentures, University of Illinois, College of Dentistry, Chicago, Ill. 791 pages. 1,000 text illustrations, nine color plates. St. Louis: The C. V. Mosby Company, 1940. Price $10.

Books in the field of crown and bridge construction are rare. This excellently organized volume, entitled "The Theory and Practice of Crown and Bridge Prosthesis," ably presents this most important subject in an interesting and technical manner. As development of crown and bridge technics has been recorded mainly through the instrumentality of papers and journals, the compilation of such important data in the form of a text-book is most timely.

The author, who is well-qualified by his wide experience to make this an authentic volume, regards the construction of crowns and fixed bridges as a means of restoring the impaired or lost biologic functions of the dental structures. He regards fixed partial denture prosthesis as a form of health service and suggests that an understanding of the principles be considered first in importance and that mechanical skill be considered only as a means to the adequate use of these principles.

Dr. Tylman served as a member of the Curriculum Survey Committee of the American Association of Dental Schools, which was appointed to outline a course of study in fixed partial denture prosthesis. The object of the course is to furnish a thorough training in the fundamentals of this type of service and its application to the general practice of dentistry. The author has obviously compiled this textbook as an aid to such a course of study.

Whereas technical procedure at best is most difficult of delineation, a thousand illustrations, supplemented by nine color plates, assist in promoting an atmosphere of clarity that leaves nothing to be desired.

The text opens with a history of the subject, followed by a discussion of its meaning and purpose. The author then deals with the reception and examination of the patient, with special emphasis on oral health, facial factors and the condition of the maxillae and mandible. Diagnosis is discussed, as are treatment prior to the actual construction, planning of the denture, hygiene and therapeutic considerations and kindred subjects.

There is a lucid delineation of some of the physical and engineering principles related to crown and fixed partial denture prosthesis, involving basic laws of physics and engineering.

A major portion of the work is devoted to the principles utilized in the preparation of the teeth for retainers. This study includes intracoronal and extracoronal retainer preparations for anterior and posterior teeth and preparations of anterior and posterior teeth for all types of crowns, especially the porcelain jacket crown, which is treated exhaustively, with a chapter devoted to modern casting technic. These chapters are replete with excellent line drawings and photographic reproductions.

Chapter 21, which will be invaluable to the practitioner, deals with classification and types of fixed partial dentures, embodying sixty-five schematic illustrations presenting various problems of the crown and bridge worker, with a suggested solution and discussion. In a later chapter, the subject of pontics is fully treated, and a timely and welcome study of dental gold alloys and their heat treatment is presented.

The volume closes with a chapter dealing with the principles involved in the construction of porcelain bridges, presenting various technics to be employed in these highly esthetic restorations. An inclusive table of contents precedes the main body of the text and a comprehensive index is appended. Extensive references appended to each chapter constitute a bibliography that can be very helpful in directing collateral study of the subject.

Owing to the clarity that inevitably results from prolific illustrating, this book is recommended to the undergraduate student, although, in some instances, it may seem a bit involved. As a reference book for the practicing dentist, it exceeds in value anything of its kind that has come to the notice of the reviewer. The text is remarkably free of typographical errors, and the paper, printing and binding are most satisfactory.

J. W. CROZIER.

The Science of Dental Materials

By EUGENE W. SKINNER, Ph.D., Associate Professor of Physics, Northwestern University Dental School. Second edition. Revised. Cloth. 421 pages with 138 illustrations. Price $4.75. W. B. Saunders Company, Philadelphia, 1940.

THIS textbook has been revised by the author to increase its adaptability to teaching purposes and to bring the factual presentations up to date. The previous form and arrangement of the volume has been kept. From the first chapters, on the structure and properties of matter, the author conducts his readers through a study of the various physical materials used in restorative dentistry. Throughout, an attempt is made to illustrate salient points by means of charts and graphs. The newer denture materials, as well as stainless steel and other alloys, are fully considered. It is difficult to see how the practicing dentist could fail to benefit from study of the contents of this book. It is certain that greater familiarity with the physical properties of the substances employed should lead to better utilization. This volume can be heartily recommended to both practitioners and students as a text and reference work.

El Paradencio: Su Patalogia y Tratamiento (The Paradentium: Its Pathology and Treatment)

By FRANCISCO M. PUCCI, D.D.S. Illustrated. 660 pages. Montevideo, Uruguay, J. Garcia Morales. Price $10.

IN this book, published in Spanish, the author has presented the most comprehensive and complete exposition of periodontal disease yet published. Beginning with embryology, especially of the supporting dental tissues, he proceeds through comparative anatomy to develop the anatomy and physiology of the dental mechanism. He then discusses the characteristics of periodontal lesions, their etiology and pathology. Diagnosis and treatment follow.

The author has quoted or summarized at length the theories of numerous authorities in the field from all parts of the world, in addition to presenting his own views. As in etiology, pathology, etc., the section dealing with treatment presents the methods advocated by leaders in the field of periodontia. The book thus comprises a compendium of responsible present-day opinion on the subject, which should be made available to English, as well as Spanish, speaking dentists, if possible.

The illustrations not only are very numerous, but also are superbly reproduced. Photomicrographs, roentgenograms, photographs of patients' mouths (some in color), photographs of casts and drawings illustrate the text in a manner to excite admiration as well as to round out the presentation of the subject. Noteworthy is the frontispiece, a full-page drawing in color of a lower premolar with its investing tissues in longitudinal section. The book has a rich bibliography and an adequate index.

It is a source of pleasure, at a time when North and South America are drawing closer together, to be able to present to North American dentists so worthy a contribution to dental science from a South American dentist.

JOHN OPPIE MCCALL.

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President's Message

GREETINGS!

To the Members of the American Dental Association:

IN assuming the responsibilities of the office of President of the American Dental Association, I am deeply aware of the honor accorded me in my election to that high office. In my earnest hope to faithfully fulfil the duties of my position, I recognize the seriousness not only of the problems which face the executives of our organization, but also of those problems which affect our entire membership.

Foremost, arising out of the international crisis, is the program of "Dental Preparedness" in which all of us of the American Dental Association will be obliged to take a part. Here, our purpose will be to give our utmost in training, in skill and in knowledge to the military authorities of our Government and to efficiently serve in the particular job that will be assigned to us in accordance with our individual abilities.

Secondly, and it must be carried out with the same enthusiasm and zealous endeavor with which it has been attended in the past, is the program of dental health education. More than ever, it will be necessary for dentists to work in behalf of the public dental welfare, to maintain high standards and to continue the tireless effort toward improving the dental health of a dependent public.

Such a vast two-fold program calls for the unceasing cooperation of each member of the American Dental Association. In an attempt to link our membership into a highly successful functioning group, each one of us has a rôle to play. That rôle calls for constructive criticism and helpful suggestions, which will be happily welcomed by the officers of our organization. It calls for any and all service which will be of use to all of us as dental practitioners and as members of organized dentistry.

The workings of an organization like the American Dental Association depend on the same kind of individual help and contributions that we see reflected in the great accomplishments of the society in which we live. The sleek streamlined locomotive speeding along its curved mountain route and flying through golden wheat fields; the regimented industrial plant, with thousands of workers acting together with timed, mechanical skill to keep the foundry fires blazing; the skyscrapers of the cities, and the steel bridges spanning the

waterways are proof of man's ability to suggest, to constructively criticize and to contribute to one common objective.

Loyally serving the American Dental Association, with each member doing his part toward attaining the goal set before us, we cannot but regard our entire body as one large family whose harmony and efficiency are due to that assistance each one of us has given. As a result of cooperation of this kind, we are able not only to look with pleasure on our past achievements, but also to anticipate with greater interest and enjoyment that which the future will bring. Just as each member of the family works for the security and happiness of the home and reaps benefits therefrom, so too will each of us benefit by the individual cooperation that we give to the great family of our dental organization.

With such participation in mind, our vast program for the coming year will entail work that we will share with renewed understanding. Let us turn these months ahead into a proud record for the American Dental Association.

Wilfred H. Robinson.

AMERICAN DENTAL ASSOCIATION
COMMITTEE ON DENTAL PREPAREDNESS

At the Cleveland meeting the following committees were appointed to cooperate with the Government in the national defense program:

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BUREAU OF PUBLIC RELATIONS

RAPPORT OF PUBLIC HEALTH OFFICIALS, PHYSICIANS AND DENTISTS IN CHILDREN'S DENTISTRY

By KENNETH R. GIBSON,* D.D.S., Detroit, Mich.

"RAPPORT" Webster defines as denoting "relation; relation especially of harmony, conformity, accord, or affinity."[1] Roget's Thesaurus,[2] more explanatory, uses such words as "link, tie, and bond" as well as "relation" and "connection," to make the meaning clear.

Interposing one or another of these, the title of this paper could read "The Relation or Link Between Public Health Officials, Physicians and Dentists in Children's Dentistry." The implication is, of course, that a close working relationship between these three agencies of health promotion will result in increased child health.

RAPPORT BETWEEN PUBLIC HEALTH OFFICIALS AND THE DENTAL PROFESSION

No one will take exception to the need of such a "bond" or union between public health officials, physicians and dentists if the objectives of children's dentistry are to be realized. Such a tie would, through dental health education, prevent much of today's dental decay of childhood with its many unfortunate sequelae. At the same time, through remedial care, the dental apparatus of many children would be restored to healthful function.

The production of health through such a bond or union must, however, be predicated on accepted fact, not assumption, such accepted fact being that public health officials regard dentistry in general and children's dentistry in particular as a public and private health procedure.

Public health has been defined as "the art and science of preventing disease, prolonging life, and promoting physical and mental efficiency through organized community effort,"[1] and public health administration as "the application of public health principles and techniques for the benefit of the community by official and unofficial organizations."[1]

In view of the almost universal acceptance by health officials of these definitions of what constitutes public health and its administration, and in view of the known and proved relationship between dental and systemic disease, it is logical to assume that public health officials would accord to the dental health program its proportionate share of the general health promotion budget.

The allocation of a reasonable budget for the promotion of childhood dental health by state and municipal health departments is, after all, the measuring rod for the relative importance that such officials ascribe to dental health.

*Director, Dental Division, Children's Fund of Michigan.

Read before the Section on Children's Dentistry and Oral Hygiene at the Eighty-First Annual Session of the American Dental Association, Milwaukee, Wis., July 20, 1939.

Although this may be true, many state and municipal departments of health have as yet failed to grant that the promotion of dental health is a public health procedure and the dental profession has deluded itself as to its importance in the general health picture.

As illustrative of this condition, a large midwestern state, granted a leader in its efforts toward protection and promotion of the health of its citizenry, allocates to its dental division the sum of approximately $15,000; whereas its total annual budget is about $1,500,000. Dental health promotion here gets 1 per cent of the annual budget.

Likewise, in the same midwestern state, the health officer in charge of its largest municipal health department allocates approximately 1 per cent of his total annual budget (about $1,500,000) for dental health promotion. Yet he has been alluded to as one of the "foremost health officers in the world" and has been made an honorary member of a large dental society.

At the outset, then, effective rapport between many public health officials and other health agents, including dentists, has been sadly handicapped through failure of such public health officials to accord dentistry a health function.

There would be no point in reporting such a condition unless it was possible to do something about it. That "something" may be accomplished through a survey of dental allocations in relationship to total expenditures of state and municipal health departments by the public health committees of national, state and other dental associations.

As illustrative of the effectiveness of close rapport between public health officials and the dental division of a foundation, there is offered as an example the growth of county and district health departments in Michigan during the past decade. In this connection, public health authorities are quite generally agreed that county and district health units are practical and efficient means of safeguarding and promoting health.

When the dental programs of the Children's Fund of Michigan began in 1929, there were four single county health units in the entire state. During the past ten years, the Children's Fund has participated in the organization of nineteen new county and district health departments serving the needs of forty-one counties. In the state as a whole, there are now fifty-eight counties having health departments, as compared with four ten years ago.

It would be erroneous to state that such county and district health departments came into being wholly because of the dental program. Such a statement would overlook the influence of the fund's nursing and health education programs and the general quickening of interest in matters of public health promotion through other organizations and interests. It is a matter of record, however, that the establishment of several of these county and district health departments and the continued local monetary appropriations to others are a direct result of a dental educational and corrective program, worked out on a cooperative basis among county and district health officers, county child health committees and the dental division of the fund.

Ten years ago, most of the sixty-four counties to which the dental programs extend had no organized health programs, as represented by county and district health units; county child health committees, or local health interests. They *did* have progressive school people, intelligent lay men and women, a very little money and a great need for dental correction and education. The fund allocated dental programs to these counties as demonstration projects, organized local county child health committees from among the key lay people, and brought county boards of supervisors into direct contact with the dental programs. In most cases, these county boards of super-

visors could see the advisability of establishment of organized health programs as represented by county and district health units, and could see also the reasonableness of local appropriations thereto, especially when they visited or learned of the dental clinics operating for underprivileged children.

To lay people, the benefits of a dental program are concrete and tangible; which is not always true of certain other health programs, though they are of equal importance. Dental programs meet a public health need, best illustrated by the statement that dental defects of school children outnumber all other physical defects combined. No other health program has done more to interest Michigan people in health, and it is to the growth of this interest that the increase in Michigan's county and district health departments is attributable.

RAPPORT BETWEEN PHYSICIANS AND DENTISTS

That a healthful and productive relationship has been achieved between physician and dentist has been my experience, in a wide personal contact with that profession, and to judge from reading the literature. There are, of course, many exceptions to this statement, but, on the whole, it must be acknowledged that medicine has conceded to dentistry a health function. This may be accounted for in many ways.

Because a physician, William Hunter, of England, called attention to the relationship between oral disease and systemic ill health, the medical profession became interested and impressed. The later corroborative findings and statements of such well-known physicians and research workers as Rosenow, Rhein, Barker, Mayo, Hayden and Black increased this respect. With support from prominent members of their own profession, physicians were more ready to accept dentistry as a part of a health profession.

Another influence in this direction has been the growth of the American Academy of Pediatrics. This organization, made up of well-trained physicians, primarily interested in the growth and development of healthy children, has, through its membership, directed the attention of literally thousands of parents to the dental needs of their children.

Medicine has accepted dentistry as a closely allied health profession and in so doing has given it a definite responsibility—a responsibility which the dental profession must embrace in a true spirit of progress. This responsibility involves participation in dental health education and adequate preventive and remedial dental care for at least that portion of the child population who can pay for service.

RAPPORT BETWEEN DENTISTRY AND ANOTHER HEALTH AGENCY

It behooves us as health custodians to take advantage of the many opportunities for cooperation between the dental profession and other agencies of health promotion. I propose to indicate briefly the broad underlying philosophy which should guide us and a specific plan for cooperation in school organization.

First, we should understand that all our efforts must be a part of the educative process, so that dental care may make a continuous contribution to the growth and development of the child.

The educative process really consists of four main phases: development of attitudes, creation of understanding, establishment of ability and performance.

True education comes only through experiences that have learning value. Learning means that a person has gone through a change as a result of an experience. These learning experiences include the necessity of recognizing and becoming interested in one's own particular problem, and then solving that problem. In the process of solving the problem, the individual is changed. Bet-

ter attitudes have been developed. He understands why, he has learned how and he is actually entering upon the activity. This means that the experience has come through the individual.

The only kind of education most of us know anything about, and which we as dentists generally promulgate, is a very different type from that which I have described. In our own learning experience, we have been told what to do and how to do it, perhaps with little interest and no personal meaning. Generally, dental education has been a projected, superimposed program of questionable learning value.

The most effective agent in all health education is the interested, informed school teacher. As a part of health education, dental health education must be developed through the school teacher as a part of the total educational experience of the child. Dental education must be a part of his total educational development, which will be a growing process continuing from year to year. In this manner, we contribute to the development of the whole child, whose social and emotional aspects, as well as his physical welfare, need consideration.

A moment ago, I spoke of a specific plan for rapport between the dental profession and another health agency, the school organization. The plan is a simple one.[2]

The specific "ways and means" of the plan are enumerated in successive steps, which lend themselves to individual dentist or dental society adaptation:

1. Meet with city or county superintendent of schools (and health officer) before the opening of the school term to develop a method of action for meeting the dental health needs of children and teachers. When agreed upon, such a plan should be reduced to paper.

2. Encourage the school administrator to present the plan outline to his teachers at their first meeting. Be present at that meeting.

3. Arrange conferences to assist small teacher-groups in making an analysis of the dental health needs of their pupils.

4. Suggest to teachers that children be encouraged to evaluate their own mouth conditions and to study ways and means of effecting beneficial changes.

5. Prepare teacher and children mentally for the dental examination by assisting them in a study emphasizing the importance of the examination. Many children are needlessly frightened by the sudden and unannounced visit of an examining dentist to the classroom.

6. Check the dental health record of children with the teacher before the examination to determine which parents are to be especially urged to attend the examination. Together with the teacher, see that all parents are invited to the examination.

7. See that each child's dental status is recorded on his cumulative health record and check his dental progress with the teacher two or more times a year to note progress.

8. Study the examination results with the teacher, giving particular attention to the records of children whose parents were not present at the examination and to the records of "underprivileged" children. Together with the teacher, study community resources for correction of dental defects.

9. Guide teacher and pupils in the development of a dental health library of reference material and check for authenticity, the children to file and index. See that this library is kept up to date by advising teacher and children as to sources of supply.

10. Lead the teacher to recognize the dental health needs of her pupils and to encourage continuous study, to promote a better understanding of the learning and growth processes of children. The precise method of such study can be left to the teacher.

SUMMARY

1. A closer bond between public health officials and dentists would result in improved child health.

2. The most satisfactory measurement of the relative importance which public health officials attach to dental health is the percentage of the total budget allocated for the dental program.

3. An example of the effectiveness of rapport between public health officials and dentists is the growth of county and district health departments in Michigan.

4. Dental programs meet a public health need.

5. Medicine has accepted dentistry as a closely allied health profession.

6. For optimal results, our efforts as dentists should be a part of the educative process in order that dental care may become a continuous factor in the growth of the child.

7. The most effective agent in all health education is the interested, informed school teacher.

8. True education comes only through experiences that have learning value.

CONCLUSION

One thing should be remembered: No dentist ever contributes to effective rapport who hides himself away in an office and whose only interest and activity are "plugging" teeth. The horizon of our world is larger than that: more is needed: energy, enthusiasm, understanding and the will to succeed. The field is before us. Our progress in the improvement of childhood dental health is directly measurable by our own efforts.

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DENTAL ACTIVITIES OF THE MILWAUKEE HEALTH DEPARTMENT

By LESTER A. GERLACH,* D.D.S., Milwaukee, Wis.

THE dental division of the Milwaukee Health Department consists of two distinct and separate staffs rendering service to the people of the city of Milwaukee. The first, or dental clinic staff, consists of five dentists, three of them on full time, working eight hours a day, five days a week, for twelve months of the year; and two dentists working one-half time, or four hours a day, five days a week for ten months of the year. The second, or oral hygiene staff, is composed of five dental hygienists working six hours a day five days a week for ten months of the year. The dental hygienists spend all of their time carrying out the dental health educational program in the elementary schools of the city.

The dental clinic service and personnel and the oral hygiene service and personnel are under the direct supervision of a one-half time dental director. The dental director is regularly employed at half time and devotes one-fourth of this time to directing the dental clinics and the other three-fourths to directing the oral hygiene program.

The dental department is a part of the

*Dental director, Milwaukee Health Department.

school hygiene division of the health department, and the dental director works with the director of school hygiene and under the commissioner of health.

DENTAL CLINICS—PROCEDURE AND POLICY

Dental clinic service is available to all indigent children of the city, regardless of age, sex, race or religion. There is no fee for any service rendered. The following policy applies to the admittance of patients to the dental clinics.

Each child under 12 years of age admitted to the dental clinic as a regular patient receives the regular dental care, consisting of amalgam, copper amalgam, kryptex, cement and zinc oxide and eugenol fillings; prophylaxis; ammoniacal silver nitrate treatments, and extractions under both local and general anesthesia. General anesthesia is either nitrous oxide or ethyl chloride, depending on the type of case and the complexity of the extraction service necessary.

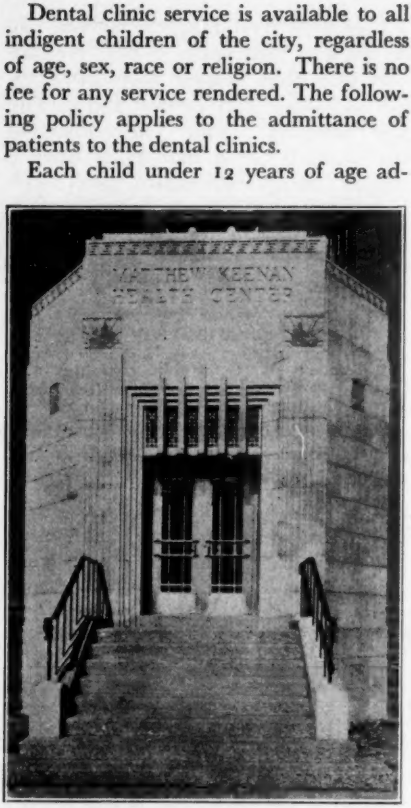

Fig. 1.—Main entrance, Matthew Keenan Health Center, housing North Side Dental Clinic.

This complete dental service is rendered to each regular patient only once during his period of eligibility as a regular patient, with the following exception: Children brought to the clinics for the regular care before the first permanent molars have erupted will receive complete dental care of the deciduous dentition and may be returned to the clinic for a repeat visit for regular care at any time before the eighth year of age has been completed. This routine will allow the doctors in the dental clinics to care for the first permanent molars after they have erupted and for at least one and a half years thereafter.

Children between the ages of 9 and 12 years making their first trip to the dental clinic for regular care will be given the complete service, but may not be returned to the clinic at any future time for a repeat visit for regular care. In other words, all children who have received regular care at one of the dental clinics will not be eligible for it again, except when such a visit is scheduled before the child has completed the eighth year, and will be given emergency care only if it should be necessary. This policy limits the number of children who may return for regular service in the dental clinics. The health department cannot hope to serve all of the indigent children in the city. This program enables the dental clinics to take care of the younger children, preserve their teeth and guard them against serious dental infection. It also allows the department to extend the scope of treatment to more of the younger children.

The complete dental service mentioned in the foregoing paragraphs is limited to children of 12 years or under. Emergency dental treatment is extended to all children of the city, regardless of age. Rarely do children above the fifteenth year of age present themselves for emergency treatment. Any child suffering

from a toothache is given emergency treatment to stop the pain. Children under 12 years of age coming in for emergency treatment become regular patients in the dental clinic only after their eligibility has been established. No teeth are extracted until the financial status of the patient has been determined.

The eligibility of families for dental treatment in the clinics is determined by the school nurses, with the help of their station supervisors. If a family makes application for free dental care, the school nurse makes a social service investigation. She enters the home and interviews the parents, obtaining the following information: number of persons in family, income, place of employment, debts, personal assets, social agencies cooperating, etc. Having received the information, the school nurse verifies it by consulting the employers of the members of the family, the social agencies aiding in the case and the debtors listed. After establishing the authenticity of the information, the school nurse consults the maintenance chart employed by the department. This chart is prepared and revised each year by the Milwaukee County Council of Social Agencies. The chart specifies the amount of income adequate to maintain persons of all ages, and includes gas, light, heat and rent of home; plus food, clothing and medical, dental and transportation costs necessary for upkeep of a home and the occupants. These figures from the maintenance chart are entered on the social history chart and totaled. If the income is above the bare necessities of life, the family does not receive free dental care. If the income is below the figure, the children receive the free care of the department.

Fig. 2.—Oral hygienist at work in dental clinic of new Gaenslen School for Crippled Children.

The value of the foregoing policies in operation of the dental clinics along the lines of preventive dentistry is very evident when comparative figures on extractions and fillings placed over a six-year period are examined.

In 1934, 8,151 fillings were placed and 12,323 teeth were extracted by the personnel of the dental clinics; whereas, in 1938, 10,227 teeth were extracted and 8,340 fillings were placed. In other words, 16 per cent fewer teeth were extracted in this period, and this time is

now devoted to oral prophylaxis and prophylactic odontotomy for the younger children entering the dental clinics for service.

ORAL HYGIENE—SCOPE OF PROGRAM

The five dental hygienists carrying out the dental health educational work enter all of the public and parochial elementary schools in the city each year with the complete program.

The staff is divided into three groups composed of two teams of two each and a fifth hygienist working alone. The teams are assigned to the large schools in the city, while the dental hygienist, working alone, covers the smaller schools. This arrangement proves more efficient and makes it possible for the staff to concentrate on the lecture work, which is the high point in any health educational program.

The dental hygienists, when entering a school on their annual visit, carry out the following procedure, which is uniform in all of the schools of the city.

Mouth examinations are made of each child in the kindergarten and first four grades, and the results tabulated on permanent dental record cards. The permanent dental record cards remain in envelopes in the schools with the complete medical records. Provision is made on them for subsequent examinations throughout the elementary school life of the child. After the examinations, each child having dental defects receives a dental defect notice with a circular of information about teeth, which is taken home to the parents.

The official dental educational material of the department consists of single printed sheets entitled "Circulars of Information on the Care of Children's Teeth." There are five of these and they are distributed to the parents in the different children's age groups for which they are prepared. The circulars are suitably subtitled and each subtitled group is of a different color, for psychologic reasons, impressing on the parents the fact that the dental health educational circulars which they receive are not all the same. Each circular describes the changes taking place during that age period and states what the parents can do to help their children maintain clean, healthy mouths and teeth.

The first circular, subtitled "Teeth of Infants During the Pre-Natal Period," is salmon colored. This circular is distributed by the special nursing supervisor in the prenatal groups.

The second circular, entitled "Children's Teeth During the Pre-School Age," is green. It is distributed to the mothers bringing their children to the preschool and child welfare clinics, which are a regular scheduled activity of the health department.

The third circular, entitled "Kindergarten Grade," and buff in color, accompanies each defect notice of the child in the kindergarten.

The fourth circular, entitled "First and Second Grades," is blue, and the fifth circular, entitled "Third and Fourth Grades," is pink. These circulars accompany each defect notice sent home by children in the respective grades.

The dental hygienists, having completed their examinations and sent home the defect notices with the educational material, arrange with the principal and teachers for their lecture work. Lectures to groups of children in the elementary schools are the most important part of a dental health program. The dental hygienists must be prepared to present the dental health material to each age group, using the following general plan. In the kindergarten and first and second grades, the material is better received and more quickly understood by the children if it is in simple story form. In the third, fourth and fifth grades, the material is presented in simple lesson form. In the sixth, seventh and eighth grades, the lessons become more complex. Since the dental hygienists reach all the schools

once each year with the program, it is possible to open the lectures in the upper grades with quizzes, in order to refresh the memories of the children so that they will be better able to absorb the new material.

All lecture work must revolve around the four points; namely, proper brushing of teeth, proper diet, proper mastication of food and regular visits to the dentist. In the sixth, seventh and eighth grades, material is added about the anatomy of the teeth and jaws, names and number of teeth, serious infections causing impairment of health following extensive caries, functions of fillings and the part the dentist plays in the general health scheme.

The department has been fortunate in the fact that all lecture work can be illustrated with some instrument of visual education. Slide machines and movie machines have been part of the armamentarium of the dental hygienists since 1933. The use of slides made from time to time has proved very successful. Many excellent movie films have been purchased for use by the dental hygienists in illustrating the lecture work.

One pronounced need at the present time is more movie films in story form for showing to the kindergarten and first and second grades. The films on the market at present are excellent for the upper elementary grades, but are too advanced for the lower grades. By those who have been showing the films routinely to children in the elementary schools, this need is felt keenly. The department has endeavored to solve this problem by making some movies of its own for showing to the younger children in the first three grades.

The original venture in this field was made in 1938, and the idea evolved upon this observation. Elementary school education has been passing through a revolutionary period. The newer method, known as progressive education, which is employed in all the schools, is characterized by project work and self-expression. This is worked out in the individual classroom, with the teacher acting as supervisor. Realizing that this advance in education was becoming more marked each year, the department was able to interest one of the principals in a project in dental health. After all, if the teachers combine such subjects as arithmetic, geography, spelling and reading in a project, why can they not combine dentistry, spelling, reading, art and dramatics in one project and call it a dental health project?

The project was organized in this manner. The teacher was instructed to put on a play, using the four points: brushing of teeth, proper diet, exercise of the teeth and jaws and regular visits to the dentist. The theme was carried out throughout the play, with the school room as the background, the classroom children as the performers and the teacher as the supervisor.

When the play was completed, it was previewed by the dental hygiene staff and adapted to movie making. A scenario was written by the dental director and the art work planned by the teachers and finished by the pupils. After several rehearsals, movies of the play were made. The department was able to purchase a movie camera with lenses and lighting equipment sufficient to take all of the shots. Coaching and direction of the children were done by the teachers and the dental director. The actual movies were taken by one of the health department employes who has made photography a hobby. Suitable editing and titling were arranged by the dental director, the teachers and the man who took the movies.

As a grand finale, a premier showing was held in the school where the movie was made. The children who performed in the play, their parents and the teachers of the school were in attendance. After the premier, the movie was given to one of the teams of dental hygienists

to be used routinely as part of the dental health educational program.

The reception given this movie by the teachers and principals is worthy of comment. Their enthusiasm as to its educational value was boundless. The reason for this is obvious: The dental health educational material is being presented to the school children in the recognized teaching technic. The material is collected and presented to the children in the same manner that the teachers present their required course of subjects. The response of the children is excellent and their knowledge of dental health is being greatly enhanced.

Since 1938, it has been the policy of the department to make one movie each year. Thus far, three have been completed and are being added to the program. With this procedure, it is possible to have a new film each year containing the same basic dental health material, but presented in a different play each time.

An observation worthy of note is that it required a great deal of time and effort to interest a principal in this venture in 1938. The school people doubted its possibilities and our ability to carry it out. However, since the first movie was made, requests have been coming in from schools asking the privilege of making one. In addition, there has never been such interest in clean and healthy teeth among the youngsters in any school in the city as can be found in the school where a movie has just been completed.

The last phase of the dental health educational program is the prophylactic work. A survey of the economic status of the schools of the city is made annually by the school nurses, and the schools are graded good, medium or poor. In the poor schools, the oral cleanliness is quite a problem. Lack of toothbrushes and proper parental guidance makes it difficult to stimulate the children to practice oral hygiene. Each hygienist is equipped with portable equipment, and when she is working in a poor school, the equipment is moved to the school. She is then able to give oral prophylaxes to the children in the second and third grades of the school. The reason for choosing these grades is that, during this period, the accumulation of food débris and stain is pronounced and the mouths of the children are filthy. Also, by choosing only these grades each year, the dental hygienists are able to give each poor child in the city an oral prophylaxis at least once during the course of his elementary school education.

CONCLUSION

The dental activities of the Milwaukee Health Department have been planned and carried out by the trial and error method. Many new features have been added from time to time, of which some have proved effective and others have had to be discarded. Public health education as carried out by an organized health department must be disseminated on a mass production scale. In other words, the more effectively the health material can be given to the public in group form with a minimum of personnel, the more efficient the program will be. The aim of the dental division has been to adopt a policy of this kind, and the movies have been a decided aid in accomplishing this purpose. All adult groups and P.T.A. lectures have also been accompanied by movies, and this practice has proved to be very successful in the field of adult education.

425 E. Wisconsin Ave.

COUNCIL ON DENTAL THERAPEUTICS

PRESCRIBING SUGGESTIONS

THE rational use of drugs and chemicals is an essential part of dental practice. Over a period of years, the Council has issued numerous reports designed to aid the dentist in the selection of drugs and chemicals of demonstrated usefulness. Many of these are National Formulary and U. S. Pharmacopoeia substances, listed and described in Accepted Dental Remedies, sixth edition. In order that the dental profession may use acceptable and official products, and to the best advantage, the following formulas have been suggested.

The Council appreciates the cooperation of George C. Schicks, assistant dean of Rutgers University and chairman of the Committee on Dental Pharmacy of the American Pharmaceutical Association, in the preparation of the formulas.

SERIES X

TREATMENT FOR ABRASIONS

a)

℞	Metric Approximate	Apoth. Equivalents
Tr. Benzoin	15 cc.	ʒ ss
Tr. Myrrh	15 cc.	ʒ ss

M.

Sig.: Apply for denture abrasions.

Note: Tr. Benzoin is a protective agent.

Tr. Myrrh is antiseptic and "promotes" normal function of abraded or diseased tissue. It is used to fix or seal drugs in gingival crevices.

EPITHELIUM "SOLVENT"

b)

℞	Metric Approximate	Apoth. Equivalents
Sodium Sulfide	17.5 gm.	ʒ iv gr. xl
Sodium Carbonate Monohydrated	5.0 gm.	ʒ i gr. xv
Water to make	30.0 cc.	ʒ i

Sig.: For external use only.

Epithelium solvent.

DISCLOSING SOLUTION

c)

℞	Metric Approximate	Apoth. Equivalents
Potassii Iodidi	3.6 gm.	gr. lvi
Iodi	3.6 gm.	gr. lvi
Glycerini		
Aq. dest. ā ā q.s. ad.	120.0 cc.	ʒ iv

Sig.: Disclosing solution.

Note: Antiseptic and aid in disclosing dental caries.

One or 2 drops of methyl salicylate improves the odor and taste.

LIQUID SOAP

d)

℞

Potassium Hydroxide	90 gm.
Sodium Hydroxide	90 gm.
Cottonseed Oil	500 gm.
Best Coconut Oil	500 gm.
Alcohol	500 cc.
Water sufficient to make	5,000 cc.

Dissolve the alkalis in 200 cc. of water and, just before solution is complete, add 200 cc. of alcohol and all of the oils. Stir or agitate rapidly until completely saponified and clear. Then add the remainder of the alcohol and water previously mixed.

As a perfume use:

Menthol	20 gm.
Oil of Clove	6 cc.
Oil of Cinnamon	6 cc.
Oil of Rose Geranium	45 cc.
Oil of Lavender Flowers	45 cc.

Mix and add to liquid soap as desired.

STIMULANT IN FAINTING

e)

℞	Metric Approximate	Apoth. Equivalents
Aromatic Spirit of Ammonia	60.0 cc.	℥ ii

Sig.: Give one-half teaspoonful in water.

Effect may also be obtained by inhaling the vapor of the spirit from a bottle or handkerchief.

Note: Aromatic Spirit of Ammonia is a useful reflex stimulant, antacid and carminative, having the action and uses of ammonium carbonate combined with those of the alcohol and volatile oil.

Dosage: 2 cc. (30 minims) freely diluted with water.
As the stimulating action is of short duration, a moderate dose may be repeated in from fifteen minutes to half an hour.

INHALANT IN HIGH ARTERIAL PRESSURE

f)

℞	Metric Approximate	Apoth. Equivalents
Amyl Nitrite Ampuls	0.2 cc.	m. iii

D.t.d. No. XII

Sig.: Break one in handkerchief and inhale vapor.

Note: Amyl Nitrite can be obtained in 3 or 5 minim ampuls. It relieves symptoms arising from high blood pressure.
Its effects are very transient. In hemorrhage with normal blood pressure, it may do harm.

Substances producing similar effects are:

Tablets Nitroglycerin, 1/100 grain
Spirits Nitroglycerin, 1 minim
Tab. Diluted Erythrityl Tetranitrate, ½ grain.

HEALTH HAZARDS IN ACETANILIDE-CONTAINING NOSTRUMS AND MIXTURES

(Continued from October Journal)

By PAUL J. HANZLIK, M.D., San Francisco, Calif.

ACUTE FATAL AND TOLERATED DOSES OF ACETANILIDE IN ANIMALS AND MAN

Because much fallacious reasoning, and misleading propaganda of nostrum manufacturers, concerning the harmlessness of acetanilide and acetanilide-containing nostrums are based on the acute fatal and tolerated doses reported for animals and the transfer of these to human beings, Tables 1 and 2 have been prepared, to indicate the quantities of acetanilide which can be given at once to lower orders, with and without sudden death resulting. Unfortunately, there are no carefully worked out distribution curves of fatal doses in different animals permitting an accurate determination of range of variations and comparison with other drugs. However, since the doses quoted in Tables 1 and 2 are the doses quoted by commercial exploiters of acetanilide, they will serve the purpose here. These doses are probably not accurate because of the poor solubility of acetanilide, which was given in suspension in acacia or in strong alcohol. The colloidal properties of acacia are likely to retard and decrease absorption, and therefore this procedure gives erratic results. Alcohol might theoretically promote absorption, but it also produces systemic depression, which might conceivably increase the tolerance for acetanilide. However, the opposite is also possible, owing to the depressant action of both agents.

For comparison, estimated fatal and tolerated doses for man have been added to those for animals. These estimates have several sources of agreement and are probably as reliable as the doses determined on animals, the uncontrolled variables and inaccuracies of which have been pointed out above. It is clear that there is a great discrepancy between both fatal and tolerated doses as estimated for animals and for human beings. The fatal dose for man is variably given, from cases of poisoning, as from about 0.03 to 0.7 gm. per kilogram of healthy adult, and only from 0.009 to 0.02 gm. per kilogram of one with cardiac or circulatory inefficiency. (Table 1.) On the other hand, the fatal doses in different rodents range from about 0.9 to 2.4 gm. per kilogram, with a median about 1.5 gm. per kilogram of body weight. In dogs, roughly one-half, or about 0.7 gm. per kilogram, will kill, a dose which is close to the average fatal dose quoted for a healthy adult man. In other words, the acute fatal dose for a sick man might be only from about one-eightieth to one-half that for a healthy man or dog, and for a healthy man, one-twenty-third that for a normal dog. But when compared with the median fatal dose for healthy rodents (1.5 gm. per kilogram), used in many misleading researches, the fatal dose for a sick man might be only one-one-hundred-sixty-sixth to one-seventy-fifth, and for a healthy man, only one-fiftieth to one-half. While these fractions are extremely variable, they are the best that can be had at present, and they show definitely that the estimated fatal doses of acetanilide are not at all comparable and actually much less than for most animals used in studies of acute toxicity.

As regards estimated tolerated doses (Table 2), with or without symptoms,

these indicate about the same discrepancy as the fatal doses, when animal dosages are compared with the maximum daily therapeutic doses recommended for man by most qualified authorities. This maximum dose amounts to about 0.02 gm. per kilogram per diem, which is roughly anywhere from about one-tenth (rabbit) to one-twentieth (dog, rabbit) to one-fiftieth (dog, mouse, rabbit) those reported for different animals. The inaccuracies in these estimates are obvious, but they are probably no worse than those for fatal doses. They show the same general tendency; namely, that man is more sensitive to acetanilide than the lower animals are.

Table 1.—Approximate Acute Fatal Doses of Acetanilide in Animals and in Man

Species	Administration	Fatal Dose (Gm. per Kg.)
White rat	Gastric (in acacia)	0.8 (50%) [32]
White rat	Gastric (in acacia)	1.2 (100%) [32]
White rat	Gastric (in 50% alcohol)	2.4 [41]
Guinea-pig	Gastric	1.5 [41]
Rabbit	Gastric (in 6% acacia)	1.5 and 1.6 [37]
Rabbit	Gastric (in 94% alcohol)	0.9 and 1.5 [37]
Dog	Gastric	0.7 fatal in 9 hours [40]
Dog	Intravenous	0.3 to 1.2 [6]
Man	Oral	0.7 (50 gm. for 70 kg.) [41]
Man	Oral	0.009 to 0.02 (0.6 to 1.3 gm.; individual with weak heart) [42]
Man	Oral	0.03 (2 gm.; normal heart) [42]

In other words, dosage in animals is not a reliable guide for therapeutic dosage in human beings, sick or well. Nor, indeed, is a symptomatic treatment with acetanilide and related drugs indicated or justified just because it appears to be successful. Some other procedure may be equally successful and more rational. Equally important, it may avoid unnecessary drugging or risking an unpredictable sensitivity of a person to these drugs.

ANALGESIA AND SYMPTOMATIC RELIEF BY RATIONAL PROCEDURES OTHER THAN USE OF ANALGESIC DRUGS

Glassberg,[43] in discussing recently the value and use of analgesics, sedatives and hypnotics, laid down procedures which physicians and dentists should follow in controlling various pains and aches, those symptoms which are shamelessly exploited by nostrum manufacturers and profiteers. He states, "Patients must be individualized, the cause of their pain sought out, their relative sensitivity to pain determined, and finally, such medicines or physiotherapeutic procedures as will afford the most direct relief prescribed." The choice of measure depends, then, on a careful diagnosis and on the judgment and thoughtfulness of the physician. It is interesting to note certain of Glassberg's recommendations for non-medicinal measures which are effective in common disorders where drugs could not be effective, a most potent argument against the promiscuous medication without diagnosis propagandized by nostrum manufacturers and distributors. For instance, headache due to closure of the antrum or the frontal sinus is unaffected by an analgesic drug, but relief is promptly obtained by the local application of a vasoconstrictor drug like ephedrine. Pain due to a foreign body in the eye may be relieved as effectively by a cold pack as by an analgesic drug. This physical procedure is more economical and freer from unpleasant after-effects than the use of a drug. The agonizing

discomfort of a gastric ulcer is readily controlled by gastric aspiration or by taking an alkaline salt such as sodium bicarbonate or magnesium. "Talcum freely sprinkled over elbows and knees may banish the 'burn' of hospital linen." An alcohol rub on swollen, painful, aching legs is preferable to alcohol by mouth or an analgesic drug. A hot tub bath at bedtime followed by a glass of hot milk may insure a night's calm repose, instead of taking a hypnotic drug, which may be, and generally is, habit forming. Simple nursing or hydrotherapy or psychotherapy procedures will often answer the purpose effectively and economically. This is not to deny prescribing and use of specific remedies for the relief of pain or discomfort, restlessness and all the vague aches, but it should be left to the physician to determine their efficacy and not to a cunning exploiter of popular credulity.

TABLE 2.—APPROXIMATE ACUTE TOLERATED DOSES OF ACETANILIDE IN ANIMALS AND IN MAN

Species	Administration	Dose (Gm. per Kg.)	Symptoms
Dog	Gastric	0.4 [6]	Salivation and restlessness
Rabbit	Gastric	0.4 [6]	Hind-leg weakness
Rabbit, white rat, dog	Gastric	1.0 [6]	
White mouse	Gastric	1.35 [6]	
Rabbit	Gastric	0.55 to 1.2 [37]	
Rabbit	Gastric	0.2 [40]	Cardiac and respiratory slowing; paralysis of hind legs
White mouse	Gastric with food	0.65 [37]	Delayed growth
White mouse	Gastric with food	0.375 and 0.065 caffeine [37]	No effect on growth
Man	Gastric	0.02 (in a day)	70 kg. adult; analgesic, antipyretic

In contrast with the judicious recommendations of Glassberg are the misleading claims concerning acetanilide and the nostrum, Bromo-Seltzer, in reports emanating from the manufacturers' representatives. Such are the so-called research reports of Lowy and Helms,[35] Helms,[44] Herz[45] and Lowy.[46] These reports capitalize acute fatal doses for rodents, which tends to mislead the public and the professions, without mention of the insidious effects on health from continued administration. The use of such data without proper qualification is to be condemned as pernicious and misleading propaganda for taking advantage of the credulity of innocent people and of the unfamiliarity of busy practitioners with the character and significance of experimental data. Only the report by Lowy and Helms[47] contains original data, which, however, are compromised by a negative opinion of the significance of the demonstrated injuriousness of acetanilide and Bromo-Seltzer for the blood. The authors admit a depressant effect of the drug on the hematopoietic organs of humans, but attempt to offset their positive results by denying them anything but minor importance. The position taken by these authors is inconsistent with their results, unjustified and misleading. They exploit only the analgesic action of acetanilide, shrouded in mystery as it is, and disregard all the rest.

NATURE OF ACETANILIDE-ANALGESIA

Nothing has been said thus far concerning the analgesic action of acetanilide and acetanilide-containing nostrums, but this action is the principal motive for their exploitation. The nature of this action remains obscure, as it has defied most careful experimental investigations. No true narcosis or central depression from therapeutic doses is evident. Changes in meningeal circulation

have been suggested. Acetanilide and other similar drugs do not reenforce the central depressant actions of ordinary hypnotics and anesthetics. They cannot take the place of many useful agents used as basal anesthetics, or of morphine and various opiates as pain-killers. They are ineffective against the pain of trauma, but relieve neuralgic and muscular pains, headache, migraine, colds and rheumatic and chronic inflammatory aches or soreness. The negative analgesic efficiency of acetanilide and a number of other coal-tar analgesics has again been recently confirmed for cutaneous tactile and pain sensitivity by Mullin and Luckhardt,[47] who used an improved and controlled method which gave positive results with alcohol and morphine. This does not argue against the analgesic efficiency of acetanilide and related agents in headache, neuralgia and the like.

However, this apparent paradox reveals the difficulties of a thorough understanding of these drugs. Studies of their actions have taxed the ingenuity of experienced and qualified investigators; but for tyro investigators and commercial exploiters, there would seem to be no challenge at all. Apparently, nostrum manufacturers do not hesitate to exploit the public and risk the people's health, in complete ignorance, and by misrepresentation, of known facts. There are many facts revealed in this report which indicate caution and judgment in the frequent, continued or indiscriminate use of acetanilide on human beings. These should be made known to the public, medical and dental professions and public health authorities, since the uncontrolled exploitation of acetanilide-containing nostrums and mixtures constitutes a real hazard to the health of the people.

CONCLUSIONS

1. Acetanilide is one of the most widely exploited coal-tar derivatives in hundreds of nostrums and proprietary mixtures of secret and variable composition, although many of these products are known to contain other potent drugs.

2. Medication with these products is commonly repeated or continued for long periods without diagnosis or medical supervision, so that the problem of indiscriminate medication and possible health hazards is one of chronic intoxication rather than acute poisoning and has important bearings on individual and public health.

3. The constituents of acetanilide-containing nostrums and mixtures may conceivably modify the actions of acetanilide by potentiation, addition, synergism or antagonism, but these possibilities have never been properly investigated, and yet modifications of the actions may determine peculiar reactions, sensitivities and hazards to health.

4. Undesired results from the continued use of acetanilide and acetanilide-containing nostrums and mixtures, which have been reported for human beings, consist of the following: addiction and abstinence symptoms: headaches, gastrointestinal disorders, anorexia, emaciation, muscular weakness, skin rashes, anoxemia, anemia, cyanosis, circulatory depression, visceral degeneration and increased susceptibility to intercurrent disease. A vicious circle tends to be established with aggravation of the symptoms originally treated with acetanilide.

5. The early blood changes in human beings are characterized by pigment changes, such as methemoglobin or sulfhemoglobin, or both, with reduction in oxygen capacity, dark oxidation products from acetanilide, hemolysis and blood destruction. The character of the dietary and sometimes other medication, especially with products containing sulfur, the use of cathartics, the state of the alimentary tract, the presence of asphyxial products and hyperglycemia and hypoglycemia are conditions, among others, little understood and which may affect hemoglobin changes, either promoting or preventing their occurrence.

6. Experimentally, the cyanosis, anemia, hemoglobin changes and blood destruction observed in humans have been reproduced in susceptible animals, but unfortunately most recent investigations have been made with non-susceptible animals (rodents) or with inadequate criteria, with negative results, and therefore are misleading and unacceptable.

7. Claims concerning the possible toxicity of acetanilide for man based on fatal and tolerated doses of the drug in animals are misleading and unwarranted, especially when acetanilide is mixed with other drugs, since the effective and toxic doses in man appear to be much smaller than those for several species of animals.

8. Since many conditions requiring relief from pain or discomfort are more rationally and properly treated by non-medicinal measures, and the nature of acetanilide analgesia is not understood, the frequent, continuous or indiscriminate use of acetanilide and acetanilide-containing nostrums and mixtures is unwise, irrational, hazardous to health and unwarranted.

ADDENDUM

In recent times, cyanosis resulting from methemoglobin and sulfhemoglobin, and possibly from other blood changes, has become so common owing to the widespread use of sulfanilamide and sulfapyridine that it seemed desirable to mention here a new therapeutic procedure for correcting this condition, as it may also be applicable to cases of acetanilide cyanosis. Hartmann, Perley and Barnett[48] have reported the successful intravenous and oral administration of methylene blue for conversion of methemoglobin to hemoglobin. The following doses of methylene blue resulted in a rapid disappearance of the cyanosis of sulfanilamide in human cases: single intravenous doses of 1 to 2 mg. per kilogram of body weight, or oral doses of 65 to 130 mg. every four hours. If oral administration is begun simultaneously with sulfanilamide therapy, the cyanosis can be prevented. A confirmation of this procedure in animals has been reported recently by Richardson.[49]

This reversibility of methemoglobinemia by methylene blue might appear to be at variance with the well-known methemoglobinizing action of the dye, which is useful as an antidote in cyanide poisoning. However, this paradoxical action of the dye can be understood in terms of oxidation-reduction changes; that is, methylene blue, as an oxidizing agent, changes hemoglobin to methemoglobin, which combines with cyanogen to form cyanmethemoglobin and thus prevents or arrests the poisoning; but the reduced state of the dye, i.e. the leukobase formed in the body, reduces methemoglobin to hemoglobin, and thus corrects the cyanosis. These phenomena illustrate some interesting complications of hematologic phenomena the significance of which is just being appreciated. When the oxidation reduction processes of the body are more fully understood, it is possible that eventually the obscure aspects of acetanilide cyanosis mentioned in this report may be clarified. To have this understanding first would be in the interest of public welfare and science, rather than afterwards, when, as in the current practice of uncontrolled and reckless human experimentation with acetanilide-containing nostrums, there has occurred unnecessary and even irreparable injury to the health of many people.

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COMMITTEE ON LEGISLATION

LIABILITY OF DENTIST FOR ACTS OF HIS EMPLOYEES

By LESLIE CHILDS, Indianapolis, Ind.

CONCEDEDLY, a dentist is liable for the acts of his employees committed within the scope of the employment. Also, liability may attach for the acts of employees committed within the ostensible scope of the employment; and, thereunder, a dentist may incur liability for even unauthorized acts of his employees, or acts committed perhaps in violation of orders.

The liability possibilities in situations of this kind may be so considerable that dentists may well have this point in mind when employing assistants, to the end that not only professional qualifications may be considered, but amenability to instructions as well. The judicial application of the rule here involved to dental employment contracts is illustrated in a line of cases.

DENTIST SUED FOR ACTS OF ASSISTANT

In Klitch vs. Betts, 89 N.J.L. 348, 98 Atl. 427, the defendant, a practicing dentist, employed an assistant. By agreement, the latter's hours were from 9 a.m. to 6 p.m., and he was to perform extractions only under the supervision of the defendant.

During this employment term, the plaintiff, a boy 10 years of age, was taken to the defendant's office by his father, arriving about 8 p.m. The defendant's assistant was in charge of the office, and, despite his employment agreement that duties ended at 6 p.m., and that he was to perform extractions only under the supervision of the defendant, the assistant extracted a tooth for the plaintiff. Thereafter, the plaintiff sued the defendant, alleging that he had suffered a fractured jaw by reason of negligence in the extraction of the tooth by the defendant's assistant.

In defense, the defendant, among other things, contended that he was not responsible for the acts of his assistant, herein involved, because such acts were committed after 6 p.m. Further, the defendant disclaimed liability because of the assistant's violation of orders not to extract teeth in the absence of the defendant. The lower court found for the plaintiff. The defendant appealed and the higher court, in affirming the judgment, reasoned, in part:

> What [the assistant] did was within his implied authority, and, even if done without the authority of the defendant, for any violation of general rules laid down for [the assistant's] guidance, the master is still responsible. When the defendant employed [the assistant] and left him in charge of his office, so that persons going there had a right to infer that he represented the defendant, the mere fact that it was after 6 o'clock did not destroy the relation of master and servant. . . .
>
> The application of the rule *respondeat superior* does not depend upon the obedience of the servant to his master's orders, nor upon the legality of the servant's conduct. Where a servant is acting within the scope of his employment and in so acting does something negligent or wrongful, the employer is liable, even though the acts done may be the very reverse of that which the servant was actually directed to do. . . . The judgment under review will be affirmed, with costs.

So too, a like conclusion was reached in McDonald vs. Dr. McKnight, Inc.,

248 Mass. 43, 142 N.E. 825, which arose under the following state of facts:

The plaintiff, suffering from toothache, entered the dental office operated by the defendant for treatment. An employee of the defendant extracted the tooth, and the plaintiff thereafter sued the defendant for injury alleged to have been caused by the negligence of the defendant's employee in performing the operation in question.

Upon the trial, there was evidence that the tooth was extracted by one F., who was not a licensed dentist but was employed as a laboratory worker. The defendant thereupon contended that since the extraction of teeth was not within the scope of F.'s employment, the defendant was not liable for the resulting injury. The lower court had rendered a verdict for the plaintiff. The defendant appealed, and the higher court, in reviewing the circumstances under which the tooth was extracted, and in overruling the defendant's exceptions to the verdict, said, among other things:

The defendant represented by signs that it was conducting a dental office, and there was evidence . . . that the plaintiff . . . entered the office, where, after stating his condition to the cashier, he sat down and waited until a young man came out of a side room and talked to him. Dr. C. then came in, called, and told F. "to take care of him." At the direction of F., the plaintiff went into a side room where, after examination, F. extracted the tooth.

The plaintiff had the right to assume that Dr. C. and F., who each wore dental uniforms, and the cashier, were employees of the defendant. . . . The defendant however offered evidence that F. was actually employed only in laboratory work. But the jury were to determine whether, as between the parties, F. was acting within the scope of his ostensible employment.

The plaintiff could not be expected, nor was he required to ask proof of the authority of the cashier, or of Dr. C. or F., all of whom he found at the office engaged in the manner previously described. He had the right to "trust to appearances, and to the not unreasonable assumption, that the defendant would not permit unauthorized persons to be so engaged." The defendant under the circumstances could not avoid liability by evidence that F.'s authority was limited. . . . The exceptions must be overruled, and it is so ordered.

As will be noted, the foregoing cases deal with the liability of dentists for injuries resulting from the unauthorized acts of employees; and here it is plain that a dentist cannot escape liability for such acts on the sole ground that he did not authorize them, if the acts complained of are ostensibly within the scope of the employment.

But this is not all: It has been held that a firm, though without legal right to practice dentistry, may be held liable for the negligent acts of a dentist who is represented to the public as an employee, though in fact not an employee. Hannon vs. Siegel-Cooper Co., 167 N.Y. 244, 60 N.E. 597, is in point.

The defendant, a corporation, operated a department store. In connection therewith, a dental department was maintained. The plaintiff sued the defendant, alleging that she suffered injury by reason of the negligence of an operating dentist in this department.

On the record, it appears that the defendant did not have the legal right to practice dentistry; and, in defense of the action against it, the defendant sought to show that it was not engaged in the practice of dentistry, and that its so-called dental department was owned and conducted by an individual.

However, upon the trial, there was evidence of a representation that the dental department was a part of the defendant's business and that the plaintiff applied for dental services with this in mind. The plaintiff had a judgment in his favor from the lower court, and, on appeal, the higher court in affirming the judgment, said, in part:

But, though it was beyond the corporate powers of the defendant to engage in the business [the practice of dentistry], this does not relieve it from the torts of its servants

committed therein . . . and the unanimous affirmance of the appellate division is conclusive to the effect that it either practiced dentistry or held itself out as practicing dentistry. . . .

It is urged that the representation that the operating dentists were the defendant's servants did not mislead the plaintiff to her injury, and therefore should not estop the defendant from asserting the truth. There is no force in this claim. If A. contracts with the ostensible agent of B. for the purchase of goods, he relies not only on the business reputation of B. as to the goods he manufactures or sells, but on the pecuniary responsibility of B. to answer for any default in carrying out the contract.

So here the plaintiff had a right to rely not only on the presumption that the defendant would employ a skillful dentist as its servant, but also on the fact that if that servant, whether skillful or not, was guilty of malpractice, she had a responsible party to answer therefor in damages. . . . Judgment affirmed.

CONCLUSION

As stated in the beginning, the question of the liability of a dentist for acts of his employees committed admittedly within the scope of the employment is hardly open to question. In such situations, the only point likely to arise will be as to whether the employee was negligent, coupled with the question of contributory negligence on the part of the patient, if asserted.

But, as we have seen, this does not cover the field of liability, for clearly the dentist's liability for acts of his employees, committed within the ostensible scope of the employment—acts committed, perhaps, in excess of authority, or even in disobedience of orders—must be reckoned with; the cases of judicial reasoning in applying the general rule to such situations, here reviewed, are squarely in point.

AMBULANCE GIFT FROM THE UNITED STATES NOW OPERATING IN ENGLAND

SEPTEMBER 4, 1940, a dental ambulance, gift of American dentists, was formally presented to the British Ministry of Health. Contributions from dentists in every part of America made this goodwill offering possible. The ambulance is equipped as an emergency operating room where injuries to the face and jaw can be given immediate attention. It is manned by a plastic surgeon, a dentist, a dental mechanic and an anesthetist, thus providing the emergency hospital scheme of the British Ministry of Health with equipment by means of which specialized services can be rushed to maimed civilians and soldiers who are unable to be moved.

C. W. Roberts, well-known American dentist practicing in England, representing his American colleagues, made the official presentation. Sir Harold Gillies, consultant advisor in maxillofacial surgery to the British Ministry of Health Emergency Hospital scheme, accepted the ambulance on behalf of the ministry.

COUNCIL ON DENTAL EDUCATION

AT a meeting of the Council on Dental Education held in Chicago on October 19 and 20, Dr. Minor J. Terry, Secretary of the New York State Board of Dental Examiners, was chosen Chairman for the ensuing year to succeed Dr. Leroy M. S. Miner, Dean of the Harvard University Dental School. Dr. J. Ben Robinson, Dean of the Baltimore College of Dental Surgery, was chosen Vice Chairman to succeed Dr. M. Webster Prince, of Detroit.

NEWS ITEMS

A HISTORICAL GAVEL FOR THE AMERICAN DENTAL ASSOCIATION

ONE of the particularly pleasing incidents of the recent Cleveland meeting was the presentation of a historical gavel to the American Dental Association.

At the meeting of the House of Delegates on Monday afternoon, September 9, Clair J. Wilson, Hays, Kan., on behalf of the Kansas State Dental Association and himself, presented to the Association a gavel made by Dr. Wilson from woods furnished by the forty-nine state dental societies, the District of Columbia,

Fig. 1.—Gavel presented to the American Dental Association by Clair J. Wilson, Hays, Kan.

Fig. 2.—Dr. Wilson and the woods from which he made the gavel.

Panama, Puerto Rico, the Philippines, Hawaii and the office of the American Dental Association. A piece of historic wood was contributed by each society and these were uniquely fashioned into a beautifully designed gavel. (Figs. 1 and 2.)

Dr. Wilson, whose hobby is woodworking, in the desire to contribute something lasting toward the Centennial Celebration of the establishment of dentistry, conceived the idea that the American Dental Association should have a gavel made from woods representative of each state and territorial dental society comprising the Association. Accordingly, Dr. Wilson addressed letters to the officers of fifty-four societies, all of whom responded by sending a historic piece of wood with a story of the history of each piece of wood. The gavel made by Dr. Wilson is in the Central Office and, together with a book composed of the letters describing the woods and their sources, makes a historical exhibit that every member should see.

To give just an idea of the historical associations of these woods, the piece that came from Alabama was taken from the White House of the Confederacy at Montgomery; that from Illinois came from the home of Abraham Lincoln at Springfield.

The official presentation was made by Fred A. Richmond on behalf of the Kansas State Dental Association.

The gavel was accepted by Dr. Merritt, President of the Association, who wielded it most capably and effectively during the succeeding meetings.

Dr. Wilson showed in moving pictures a story of the woods and the making of the gavel, which was interesting indeed.

CONGRESS ON DENTAL EDUCATION AND LICENSURE

THE Council on Dental Education has felt the need of a forum for the discussion of the common problems of teaching, examining and licensing in dentistry. There are thirty-nine dental schools in the United States engaged in the education and training of future dentists. There is a board of dental examiners set up under law in each state in the Union and in the District of Columbia for the purpose of examining and licensing the graduates of dental schools who seek to engage in practice. There is also a national board of examiners, constituted by the American Dental Association, whose examinations in the theory of dental science are accepted by several state boards in lieu of their own examinations.

The American Association of Dental Schools, the National Association of Dental Examiners, representing the several state boards, and the National Board of Dental Examiners all have annual meetings and issue full reports of their proceedings. All these agencies have a common goal, the education and proper licensing of dentists and the protection of the public against incompetency and quackery. While these groups have long worked harmoniously together, they have never pooled their interests or considered their common goal in joint session.

The Council on Dental Education is planning a congress on dental education and licensure, which will be the first national meeting in this country devoted to the common problems of teaching and examining in the field of dentistry. Through the courtesy of the Chicago Dental Society, the congress will be held at the Stevens Hotel in Chicago, Saturday, February 15, 1941, in connection with the Midwinter Meeting of the society.

The congress will be devoted to the

related problems of dental education as carried on by the dental schools and the licensing of dental practitioners as carried on by the dental examining boards. Both dental faculties and examining boards have long felt the desirability of a closer understanding of their common interests. The Council on Dental Education proposes to bring these agencies together and to arrange a program of papers and discussion which will serve to emphasize the interrelation of teaching and examining and give added dignity to the dental profession.

Invitations will be especially extended to all dental faculties, to all dental examining boards and to college and university officials interested in professional education, and all dentists attending the Midwinter Meeting of the Chicago Dental Society will be welcomed. Invitations will also be extended to dental faculties and provincial examining boards in Canada. The Council on Dental Education hopes that this first congress will inaugurate a continuing series of annual meetings devoted to the education and the licensing of dentists.

FREDERICK B. NOYES HONORED

ON the evening of September 14, at the Lake Shore Athletic Club, Chicago, Frederick B. Noyes, retiring dean of the University of Illinois, College of Dentistry, was tendered a testimonial banquet by the faculty of the university and his host of friends of the dental profession.

The testimonial banquet signalizes the retirement of Dr. Noyes from the deanship of the College of Dentistry, a position he has held with distinction for fourteen years. From a family of three generations of dentists, Dr. Noyes has been for many years a distinguished teacher, dean and contributor to practically every phase of dental practice. His most notable contributions have been to histology and to orthodontia, but he has also, throughout his tenure of office as dean, made an indelible impression on the development of dentistry as an autonomous profession.

The banquet was participated in by many of his distinguished confrères. Allan G. Brodie acted as toastmaster and introduced as the principal speakers Arthur H. Merritt, New York, LeRoy M. S. Miner, dean of the Harvard Dental School, Arthur C. Willard, president of the University of Illinois, the Rev. R. Everett Carr, rector of St. Peter's Episcopal Church, Park Ridge, and Isaac Schour, of the College of Dentistry, all paying tribute to the distinguished service that Dr. Noyes has rendered to dentistry.

It was an outstanding occasion in the year in which dentistry has fittingly celebrated the centennial anniversary of its foundation as an organized profession.

NATIONAL HEALTH PROGRAM COMMITTEE

THE Dental Research Bill, S. 3607, was passed by the Senate of the United States without amendment on September 12. This bill, introduced by Senator James E. Murray, of Montana, authorizes the United States Public Health Service to conduct research relating to the cause, diagnosis and treatment of dental diseases. The sum of $75,000 is appropriated for the next five years with an annual increase of $10,000 to defray the cost of such research.

The bill is now before the House of Representatives for approval and has been referred to the Committee on Interstate and Foreign Commerce, of which Representative Clarence F. Lea, of California, is chairman.

OBITUARY

NORMAN J. ROBERTS, D.D.S.
1860-1940

DIED, June 24, 1940, at his home in Waukegan, Ill., Norman J. Roberts, D.D.S.

He was born in Chicago, Ill., of Welsh and French parentage. His father was of pioneer Chicago stock. He graduated from Waukegan High School in 1880 and entered the Baltimore College of Dental Surgery, graduating in 1882. He also took courses at Johns Hopkins University while in Baltimore.

Dr. Roberts took an active part in dental college affairs, in the early years of their beginnings in Chicago, as well as in dental legislation of the state board. He was president and professor of oral surgery in the Northwestern College of Dental Surgery in 1885. Later, he was clinical professor of orthodontia and anesthetics in the Chicago College of Dental Surgery, from 1888 through the nineties. He took special courses at Rush Medical College in 1886.

Dr. Roberts was a member of the Chicago Dental Society, Illinois State Dental Society, American Dental Association, American Medical Association, Illinois State Medical Society and Lake County Medical Society.

From his entrance into the profession through the fifty-eight years of his practice, Dr. Roberts was ruled by but one ambition—to excel in his work, to discover and perfect new and better methods and to perform operations not usually attempted. He explored every department of dentistry—mechanical, medical, surgical—and, in his pursuit of knowledge, he achieved a distinguished place, rich in all the rewards that his profession can bestow. Of prodigious energy and enthusiasm, limitless capacity and love for study, research and experiment, he gave his entire life to his work, to which all else was secondary.

No sacrifice of time, rest, vacations, health, was too great to offer to his beloved profession and patients. He never cared to leave "The Gables," the office he built and in which he lived and worked for fifty years—a Mecca to which his patients journeyed from far and wide. Dr. Roberts possessed the rare gift of inspiring confidence and affection, and gave his friendship and often unrewarded service to a far-reaching as well as a local circle, to whose welfare he was devoted professionally and otherwise. He did not change from the ideals and standards of his early years: to give the utmost in skill and service for moderate recompense. He was not moved by the many fads that came and went through the years.

To those who knew him best, his strongest attribute was courage of a high order. He refused to admit defeat or failure in anything, and he overcame much. His creed was "Work, and all else shall be added"—a message to the young man starting out today, and as true as it was in another age.

DEATHS

AMES, CHARLES M., Chicago, Ill.; Chicago College of Dental Surgery, 1914; died July 6; aged 61.

BAKER, WALTER S., Oakland, Calif.; North Pacific College of Oregon, 1923; died recently; aged 43.

BARNABY, WALTER J., Cedar Rapids, Iowa; Ohio College of Dental Surgery, 1901; died May 30; aged 67.

CABEEN, JOSHUA D., Galesburg, Ill.; University of Pennsylvania, School of Dentistry, 1900; died August 11; aged 64.

CARLIN, BENEDICT, New York, N. Y.; New York University College of Dentistry, 1917; died recently.

CLARK, GROVER C., Trenton, Mo.; St. Louis University School of Dentistry, 1917; died June 27; aged 48.

COLBURN, MYRON L., New York, N. Y.; New York University College of Dentistry, 1895; died May 21.

COPLEY, HARRY, Joliet, Ill.; Northwestern University Dental School, 1888; died October 1; aged 77.

EVSEROFF, JACOB, Brooklyn, New York; New York University College of Dentistry, 1913; died recently.

GAMBREL, JOHN B., Belford, Ind.; Indiana University School of Dentistry, 1908; died July 28; aged 60.

GASTON, EDMOND A., Axtell, Kan.; Kansas City-Western Dental College, 1900; died April 20; aged 64.

HADDEN, GILBERT E., Austin, Ill.; Northwestern University Dental School, 1923; died August 28; aged 42.

HURDLE, ROY V., Danville, Ill.; American College of Dental Surgery, 1892; died August 15; aged 72.

JARVIS, CHARLES FITZ-HOWARD, Oakland, Calif.; University of California School of Dentistry, 1897; died recently; aged 64.

KIRKLAND, JAMES A., New York, N. Y.; Chicago College of Dental Surgery, 1899; died July 28.

KNAPP, JAMES FRANKLIN, Brooklyn, N. Y.; New York College of Dentistry, 1891; died August 16; aged 74.

MCCONALOGUE, WESLEY, Detroit, Mich.; University of Michigan School of Dentistry, 1915; died July 19; aged 46.

MCCORMICK, HENRY G., Normal, Ill.; University of Michigan School of Dentistry, 1903; died April 26; aged 60.

NATHAN, CHARLES, Brooklyn, N. Y.; New York University College of Dentistry, 1902; died recently.

NORTON, IRA P., La Porte, Ind.; Chicago College of Dental Surgery, 1900; died August 17; aged 72.

PARKER, ALLISON J., New Haven, Ind.; Temple University School of Dentistry, 1885; died August 19; aged 82.

PEER, HOMER, Urbana, Ill.; Chicago College of Dental Surgery, 1915; died August 15; aged 61.

SAGE, ALBERT O., Concordia, Kan.; Kansas City Dental College, 1891; died recently; aged 75.

SAUNDERS, CHARLES H., Traverse City, Mich.; Indiana University School of Dentistry, 1919; died May 18.

SCHOVERLING, CLIFFORD S., Houston, Texas; Texas Dental College, 1912; died recently.

SHIELDS, NELSON T., New York, N. Y.; Baltimore College of Dental Surgery, 1884; died July 15.

SNYDER, A. M., Bloomington, Ind.; Indiana University School of Dentistry, 1908; died August 16; aged 59.

SWARTZ, FREDERICK H., Chicago, Ill.; University of Illinois College of Dentistry, 1903; died August 9; aged 56.

WEATHERWAX, WALTER J., Peoria, Ill., Chicago College of Dental Surgery, 1900; died August 26; aged 61.

CORRESPONDENCE

"STUDIES ON THE LOCAL FACTORS IN DENTAL CARIES"

To the Editor:

The subject of dental caries is too important to allow certain statements in Dr. Hanke's recent paper (J.A.D.A., 27:1379, September 1940) to go unnoticed, perhaps later to be taken for granted and accepted for fact.

In Section II, page 1382, Hanke states that incubation of saliva to which sugar has been added depresses the pH to 4.2 — 4.4, and then draws the following unwarranted conclusion: "It is evident, therefore, that the mixture of bacteria that can be found in any mouth is capable of producing a degree of acidity sufficient to dissolve dental enamel completely." What happens in the test tube does not necessarily happen in the mouth.

No cognizance is apparently taken of the buffering action of saliva *in vivo*. As a matter of fact, actual pH determinations of saliva have shown that the pH is generally around 6.5 (Grossman, L. I., and Brickman, B. M.: *J. D. Res.*, 16:409, October 1937) and that, in a few cases, when chocolate or candy had been given the subject fifteen minutes before the test, the pH was depressed from 0.4 to 0.6 with recovery to normal in less than two hours (*Idem:* Unpublished data).

On pages 1379 and 1382, Hanke criticizes the use of litmus, yet he is satisfied with another type of color indicator for determining the pH of carious material. While the methyl red is admittedly a more delicate test than the litmus, it is inadequate for a study wherein precision determinations are of great importance. For this purpose, the potentiometric method would have been more dependable. By the colorimetric method, Hanke found the pH of dried carious lesions in the mouth to be pH 5 or below. With a Beckman pH apparatus (Grossman, L. I.: *J. D. Res.*, 19:171, April 1940), the mean pH of carious dentin was found to be 6.51, with a standard deviation of 0.356 units, while the mean for sound dentin was 8.16, with a standard deviation of 0.356 units, while the mean for sound dentin was 8.16, with a standard deviation of 0.217 units.

On page 1383, Hanke states: "From this, we conclude that plaques menace the teeth because sufficient acid can develop in them (especially after eating carbohydrates) to dissolve dental enamel." This is an erroneous conclusion because (1) no control of pH of saliva was made, and (2) no accurate determination of the pH of the plaque was made.

On pages 1383 to 1389, in dealing with the nature of the plaque and its removal, he fails to mention several agents which were found by Nichols, Hatton and Doherty (J.A.D.A., 20:707 April 1933) capable of completely removing mucin films. Among them were lime water, fruit acids and galactonic lactone, all much simpler agents for daily use than organic mercurials. It might be mentioned here that Hanke seems to regard the plaque as a bacterial plaque rather than a mucin plaque and focuses all his attention on destruction of the bacteria in the plaque.

The statement is made by Hanke (page 1392) that "dental caries has been definitely arrested in fifteen patients" who consistently used an oral antiseptic containing p-hydroxymercuribenzoate once or twice daily. No record of the length of time during which these patients used the mouth wash is given. Was it six months or six years? How were the observations controlled? Even caries-susceptible individuals pass through periods when they are relatively caries-free. How old were the patients? Are they past the teen age, the period of relative susceptibility? These questions are pertinent if one is to evaluate Hanke's work and accept it as a serious contribution to the etiology and prevention of dental caries.

LOUIS I. GROSSMAN, D.D.S.,
Philadelphia, Pa.

REQUEST FOR AID IN IDENTIFICATION

THE sheriff of Redwood City, Calif., recently made public the discovery of the body of a woman in 1934 near Skyline Boulevard in San Mateo County, California. The description was as follows: brown hair, henna wash; approximate age between 30 and 40 years; weight 130 to 140 pounds; height, 5

feet, 8 inches. The woman had been dead for about three months.

Mrs. Jeane Hartman, of Pine City, N. Y., believes that the body may be that of her sister, who disappeared about the time of the discovery of the body. She writes:

Fig. 1.—Photograph of Miss Schumacher who disappeared from New York in 1935.

"I am enclosing a letter and chart sent to me by Sheriff Nieri; also a picture of my sister, Nellie Schumacher, who disappeared just three months before this body was found. The picture was taken many years ago. Because of the extremely hot weather and the length of time that had passed, the only way to identify the body seems to be to find the dentist who did the dental work. That is why I am appealing to you to help me. Nellie was a graduate nurse and had worked many years in San Francisco. She was 46 years old when she disappeared. If it is possible, will you make a print of the chart in THE JOURNAL and request the dentist to please communicate with us at once? Any aid in identifying the body will be appreciated.

JEANE HARTMAN,
R. F. D. 1,
Pine City, N. Y.

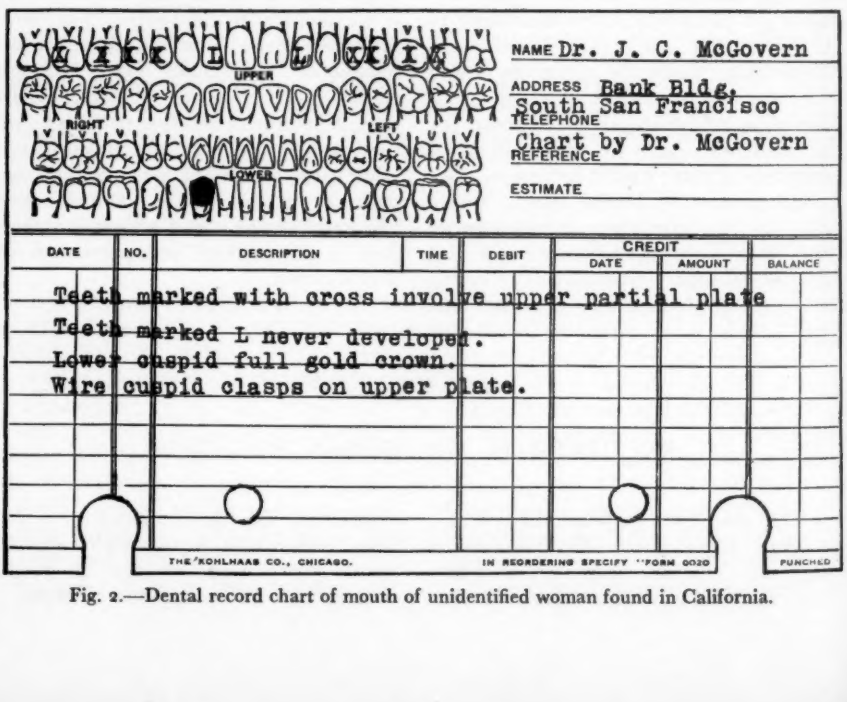

Fig. 2.—Dental record chart of mouth of unidentified woman found in California.

CURRENT LITERATURE

Tissue Changes Following Rotation of Teeth in the Dog

By William J. Skillen and Kaare Reitan

The authors have conducted experiments to determine the tissue changes resulting from the use of forces and appliances of various type in the rotation of teeth of dogs. The forces used, heavy, medium and light, were further divided into intermittent and continuous. Three different types of appliances were used.

Their results throw considerable light on the details of tissue changes which occur in any movement of the teeth. They also indicate that the distance through which a tooth moves and, to a certain extent, the tissue involved must be considered in order to avoid too much injury to the supporting structures.—*Angle Orthodontist,* **10**:140, July 1940.

W. J. Koss.

Plea for the Better Understanding of Pyorrhea Alveolaris

By S. A. Richards

The author maintains the necessity for a better understanding of the causes of pyorrhea. More attention should be attached to the conservative branches of dentistry, such as periodontia, to avoid the sacrifice of countless teeth. Gingivitis, an inflammation of the gums, must not be confused with pocket formation, or pyorrhea. Numerous causes of this condition have been set forth. The author believes that pyorrhea is the result of muscular action, either direct or indirect, in the presence of food débris on the teeth. The degree of cleanliness of the mouth as well as defective health, faulty arrangement of the teeth and the presence of chemical poisoning, will influence the disease. Susceptibility and immunity are governed by the degree of strength of the periodontal membrane, which is purely mechanical, not physiologic.

The author maintains that both caries and pyorrhea are dirt diseases, but the question as to which will develop is determined by the accessibility of the food débris which has lodged upon the teeth.—*D. J. Australia,* 12:451, August 1940.

A. Pearson.

Devitalisierung von Lebenden Pulpen Durch Diathermie (Devitalization of the Vital Pulp with Diathermy)

By S. S. Lindholm

The author treated 116 cases of pulp extirpation using diathermic therapy. Of this number, twenty-six had sound intact pulps, thirty-two were diagnosed as acute pulpitis and fifty-eight were classified as chronic pulpitis. Clinical and x-ray examinations from four to forty months after extirpation disclosed that 97 per cent of all the cases were successful. The percentage of successful cases varied from 92 to 100 per cent in the three groups, the perfect results being noted in cases previously classified as chronic pulpitis. The advantages of the therapy are enhanced by the fact that coagulation, extirpation and filling of the root canal may be performed at one sitting.—*Acta Odontol.,* 2:33, June 1940.

J. H. Volker.

Evaluation of Root Resorption Occurring During Orthodontic Treatment

By Charles R. Rudolph

The author made a study of 513 orthodontic patients treated in an undergraduate clinic. Dental roentgenograms were obtained before orthodontic treatment was instituted and at approximately one year intervals during the course of treatment. Labial appliances were used in the majority of cases. Treatment was carried out by students, and adjustments were made each week. In a group of forty-seven patients who were 9 years of age at the onset of treatment, the incidence of root resorption for each successive year of treatment was 6, 30, 66, 86, 94, 97 and 100 per cent, respectively. In contrast to this 9-year-old group, the incidence of root resorption for each successive year of treatment in 110 patients in the

12-year-old group was 49, 81, 97, 99 and 100 per cent.

For purposes of comparison, the roentgenograms of 4,560 patients with no history of orthodontic treatment were studied. The individuals in this group ranged in age from 7 to 79 years, and the incidence of root resorption in this group was 13 per cent. However, when the 739 patients ranging in age from 7 to 21 years, the age group comparable to that of orthodontic patients, were segregated, only 5 per cent showed root resorption. The patients were over 13 years of age.

The author suggests that orthodontic treatment is less hazardous to the root structures when it is initiated at an early age and can be prolonged without permanent loss of root tip structure.—*J. D. Res.*, 19:367, August 1940.

JAMES T. GINN.

Bacteriology of Trench Mouth and Its Treatment

By CHARLES DILLON

VINCENT'S infection, essentially a disease of tropical and subtropical countries, occurs where there are large masses of people. The author is convinced that Vincent's spirochete and *B. fusiformis* are two distinct organisms. It has been his experience in tropical countries that patients who are infected with yaws and also Vincent's organisms show an aggravation of stomatitis and a marked improvement of yaws when treated for the latter with bismuth subnitrate. By intravenous injections of neo-arsphenamine for the treatment of yaws, the number of spirochetes was greatly reduced, but the fusiform organism remained in large numbers. To successfully clear up the local condition, the author uses a non-alcoholic iodine-potassium iodide-glycerine solution, following which perborate is applied and worked into the interdental spaces.—*Brit. D. J.*, 68:235, March 15, 1940.

A. PEARSON.

Dental Disease in Pregnancy

By JAMES CAMPBELL

THE fact that Fish (1932) and other reliable investigators have proved that there is no withdrawal of calcium from the teeth during pregnancy, and that, in experimental animals, even complete removal of the parathyroid glands results in no change in the calcium content of the teeth, although the skeleton may be robbed of nearly all of that mineral, would indicate the fallacy of the old assumption of an increase in dental caries due to pregnancy. Any increase that was evident might easily be explained by lowered resistance to sepsis, poor hygiene or failure of the dentist to carry out necessary operations in fear of causing abortion.—*Brit. M. J.*, 2:268, August 24, 1940.

H. B. MCCAULEY.

Osteomalacia and Dental Caries

By G. F. TAYLOR and C. D. M. DAY

A DENTAL examination of twenty-two severe cases of osteomalacia in the Kangra district of the Punjab showed an average of 1.54 cavities. Eight women had no caries, seven showed hypoplasia and eleven had pyorrhea. Seven children born of these women had severe rickets, but showed only two cavities in 144 teeth. Because mottled enamel was not observed, fluorine is discounted as an immunizing factor.

These findings are interpreted as showing that bone decalcification and pregnancy have little effect on the teeth. The value of vitamin and calcium therapy for caries is questioned.—*Brit. M. J.*, 2:221, August 17, 1940.

B. G. BIBBY.

Traumatic Injuries in the Jaws of Infants

By JOSEF WEINMANN and RUDOLF KRONFELD

IN the systematic examination of sections through the jaws of many infants, ranging in age from the intra-uterine period to several years after birth, the authors found much evidence of traumatic injury in the bone sutures, unerupted tooth germs and erupting teeth. It is suggested that the injury to the bone suture is brought about by some kind of shift or relative displacement, or bone spicules growing toward each other at the expense of the intervening connective tissue. Normally, the bony crypt responds with resorption to an increase in the size of the tooth germ. If any area of the bony crypt fails to respond to normal resorption, the space between the bone and the tooth germ is reduced, and the intervening connective tissue in a circumscribed area is compressed, with traumatic injury to the tooth germ. Traumatic deformation of

Hertwig's sheath may result in a minor deformity of the root, and possibly the crown. The authors conclude that these traumatic injuries usually are repaired, with the possible exception of changes affecting the normal contour of the growing root.—*J. D. Res.*, 19:357, August 1940.

JAMES T. GINN.

Osteoma of the Maxillary Sinus

By A. G. RAWLINS

AN osteoma is a more or less encapsulated bony tumor attached to the bone, from which it arises. It may mechanically displace the surrounding structures. There are many theories concerning its origin. It is believed to arise from the periosteum, and an external irritant may be necessary to its development. The two common irritants are injury and infection. The tumor may be of hard or spongy bone and it may or may not present symptoms, as follows: 1. Swelling of the cheek or alveolus. 2. Exophthalmos. 3. Pain. 4. Epiphora. 5. Diplopia. 6. Loss of sight.

The treatment of these tumors is always surgical. Report of a case is included. —*Arch. Otolaryn.*, 32:499, September 1940.

E. C. WOODS.

The Lower Jaw

By ALES HRDLIČKA

THIS article presents the findings of a study of more than 3,000 lower jaws. The study was limited to the gonial angle and the bigonial breadth. Skulls from people all over the world were examined. From the study of the angle, it has been shown that the white race has the highest (most oblique) angle, the American Indian the lowest. It was found that the angle was higher in the female than in the male. The people of the Arctic and Subarctic were found to have the broadest jaws, those of southern groups the narrowest. The difference in breadth is believed to be functional.—*Am. J. Phys. Anthropol.*, 32: September 1940.

E. C. WOODS.

Effect of Castration and Hypophysectomy on the Gingiva and Oral Mucous Membranes of Rhesus Monkeys

By DANIEL E. ZISKIN and S. N. HACKBERG

THE authors studied the effects of castration and hypophysectomy on the gingiva and oral mucous membranes of monkeys. Castration of female Rhesus monkeys caused an altered arrangement of the prickle-cell layer of the alveolar and areolar gingivae and tissue degeneration. Hypophysectomy caused marked degenerative changes in the gingivae and oral mucous membranes of female animals. Castration of male monkeys caused changes in the gingivae and oral mucous membranes resembling the effect of injection with the estrogenic hormone; namely, hyperkeratinization.—*J. D. Res.*, 19:381, August 1940.

JAMES T. GINN.

Effect of Fluorine on Mouth Bacteria

By B. G. BIBBY and M. VANKESTEREN

THIS is the first correlated study of the effect of ingestion of fluorine on bacterial growth and acid production to be reported. Streptococci, lactobacilli and other mouth organisms were tested, and the action of fluorosed and fluorine-treated dental tissues was observed.

Fluorine concentrations of less than 1 part per million limited acid production by bacteria, but in order to affect bacterial growth concentrations in excess of 250 parts per million were needed. The acid production was similarly reduced by fluorosed and fluorine-treated enamel and dentin.—*J. D. Res.*, 19:391, August 1940.

R. F. SOGNNAES.

Wrought Metal for Technic Use

By GEORGE S. EASTON

A STUDY was instituted for the purpose of investigating several possible sources of an inexpensive wrought metal which would meet the requirements for technic use. An alloy of copper and beryllium, containing 2 to 2-1.2 per cent beryllium, was found to be the most suitable. This alloy is referred to as B-C metal, and the author found its properties to be such that it may be used as a technic substitute for wrought gold alloys in practice manipulation and the construction of display models. In strength, elasticity, elongation and melting range, it is quite comparable to many of the wrought golds. It will take and retain a high polish. It has a satisfactory copper color and will take a gold plate readily. It responds to the same type of heat treatment procedures as do the wrought golds, and its response is such that

its properties can be varied to a great extent. It can be soldered with technic or gold solder, although the operation is not accomplished as easily as it is when wrought golds are used. B-C metal cannot be used repeatedly because of the loss of beryllium by oxidation at high temperatures and consequent softness. It cannot be cast satisfactorily.—*J. D. Res.*, 19:403, August 1940.

JAMES T. GINN.

Simple Colorimetric Method for Estimation of Relative Numbers of Lactobacilli in the Saliva

By M. L. SNYDER

THE author describes a simple colorimetric method for the estimation of lactobacilli in the saliva. Saliva, 0.1-0.2 cc., is inoculated in "shake" tubes with bromcresol green-glucose or lactose infusion agar, and the color changes after forty-eight hours are used as indicative of acid production. When compared with plate counts of lactobacilli, the method proved to be accurate enough to select samples with less than 1,000 lactobacilli per cubic centimeter of saliva.—*J. D. Res.*, 19:349, August 1940.

R. F. SOGNNAES.

Effect of Application of Vitamin D to Dentin in Dogs

By P. S. FAILLO and C. I. REED

TOPICAL application of vitamin D in prepared cavities in the teeth of dogs is shown to result in systemic effects manifested by hypercalcemia and hypercalcia in soft tissues. Any local changes such as secondary dentin formation appeared independently of the vitamin D application. Contrary to Weinmann, these deposits could not be attributed to a local calcifying effect of vitamin D.—*J. D. Res.*, 19:373, August 1940

R. F. SOGNNAES.

Tender Teeth: Their Gingival Importance

By H. T. ROPER-HALL and A. P. BERTWISTLE

WHILE relief from toothache is sought by extraction of teeth, the milder pain occasioned by chewing, percussion or contact with hot or cold water is generally endured by the patient. This tenderness, which may be transitory, reappearing after weeks or months, may lead to serious trouble.

Suggested causes of the condition are cold in the teeth, pregnancy and lactation, loss of the pulp, affections of the antrum, sarcoma of the alveolus, tumors of the palate, fracture of the jaw, osteomyelitis, necrosis of jaws, scurvy, anemia, leukemia and mechanical conditions. The effects of such irritations on neuralgia, hysteria, migraine and neuroses should be kept in mind.—*Brit. M. J.*, 2:188, August 10, 1940.

B. G. BIBBY.

Histologic Response of the Teeth of Dogs to Operative Procedures

By W. B. GURLEY and GRANT VAN HUYSEN

TEETH of dogs in which cavities had been filled with zinc oxide and eugenol for a period of six months showed nothing but reticular atrophy of the whole pulp when examined histologically. The placing of gutta-percha in cavities for the same period of time was followed in most but not all instances by deposition of secondary dentin, generalized reticular atrophy and cellular infiltration. The use of cement caused the above mentioned changes in the pulp and dentin, which continued over a period of six months.—*J. D. Res.*, 19:179, April, 1940.

GRANT VAN HUYSEN.

Recruit Selection

By ROBERT A. BELL

IN the selection of recruits for both the Navy and the Marine Corps, in all groups of applicants examined the greatest number of rejections were due to dental defects of some nature. Of one group of 1,000 applicants, roughly 75 per cent were rejected. The major disqualifying defects listed as causes of rejection were: dental, 196; flat feet, 131; defective vision, 73.—*U. S. N. M. Bull.*, 301-306, July 1940.

W. F. KOSS.

Rapid Method of Differentiating Children with Large or Small Reserves of Vitamin C

By JOHN PEMBERTON

EARLY tests of the adequacy of vitamin C storage based on urinary analysis have been inadequate owing to their impracticability in other than hospital cases. Experiments show, however, that specimens of urine taken from normal persons on an adequate diet invariably contain ascorbic acid concentra-

tions within well-defined limits (between 0.76 and 3.0 mg. per hundred milliliters). When the concentration rises between 3.0 and 6.0 mg. per hundred milliliters, it is noted that extra quantities of fruit had been consumed. Six hours after a large test dose of 70 mg. ascorbic acid per stone (14 pounds) of body weight in an adult, the level in the urine rose to a maximum well above 25 mg. per hundred milliliters.

The method of urinalysis is that described in 1935 by Harris and Ray. The specimen is acidified with glacial acetic acid to 10 per cent by volume and stored in the dark. It is titrated into a freshly prepared solution of 2:6 dichlorophenol-indophenol, 5.0 ml.=0.1 mg. ascorbic acid. The end point, discoloration, is reached in two minutes.

In subsequent experiments based on the assumption that by giving a large test dose of ascorbic acid and taking a six or eight hour specimen of urine, a person whose vitamin C storage is adequate will show a high level of ascorbic acid, whereas a person in whom it is inadequate will fail to show a marked increase of ascorbic acid, two groups of boys were segregated and their diets, respectively, were supplemented and unsupplemented with vitamin C. The reducing substance in the urine other than vitamin C, even in cases of tuberculosis, peptic ulcer or diabetes, when a large test dose is given, is minimal. —*Brit. M. J.*, 2:217, August 17, 1940.

H. B. MCCAULEY.

Diagnosis of Syphilis of the Mouth

By EWELL I. THOMPSON

THE author presents a concise account of the typical syphilitic lesions seen in and about the mouth, in all three stages. The gross appearance, site of occurrence, onset, subjective symptoms and differential diagnosis are discussed. The frequent site of the chancre is the lips, where infection takes place through kissing or contamination from instruments or drinking cups.

The secondary stage may develop in from four to eight weeks after the chancre appears. In the mouth, the common manifestation is the mucous patch, which may occur on the tongue, tonsils, pharynx, gums or lips.

The tertiary stage begins two years after infection. The principal lesion is the gumma, which may be seen in any part of the mouth, but is usually under the tongue and on the hard palate. The dentist may see lesions in each of these three stages in the mouth. —*D. J. Australia*, 12:488, August 1940.

A. PEARSON.

Relations of Endogenous and Exogenous Factors in Bone and Tooth Development: Teeth of the Grey-Lethal Mouse

By HANS GRÜNBURG

THE grey-lethal mutation in the house mouse is characterized by a lack of yellow pigment in the fur, failure of tooth eruption and, without artificial feeding, death between the twenty-second and thirtieth day. Liquid food prolongs the life for a fortnight or so. The main feature of the skeleton is the entire lack of all secondary absorption processes. Thus, bone substance once laid down in development is preserved in its entirety. The grey-lethal rat when compared with litter mates shows a lack of development. The lower first molars are of proper root development as compared with the normal. Histologically, there is evidence of a lack of bone absorption about the alveoli containing the developing molar teeth. The incisors are also poorly developed. The size and shape of the teeth are apparently limited by the failure of bone absorption of the surrounding crypts. The author concludes that bone reacts by absorption under the influence of pressure only if the hereditary basis for doing so is undisturbed. The relation between stimulus, that is mechanical stimulus and response such as bone absorption, is therefore not a direct one.—*J. Anat.*, 71:236, January 1937.

GRANT VAN HUYSEN.

Overbites

By SHERWOOD R. STEADMAN

ANY arrangement of the teeth in which the maxillary incisors overlap the mandibular incisors when the jaws are closed is considered an overbite. The solution of any overbite difficulty lies in the proper analysis of the curves of Spee in both the upper and the lower arches. The curve of Spee may be one of four types: 1. Advisable. 2. Excessive. 3. Flat or absent. 4. Reverse. In addition, the author presents four variations for each of these types.—*Angle Orthodontist*, 10:148, July 1940.

W. J. KOSS.

PRACTICE IN PARAGRAPHS

A Prosthodontia Pointer—To adherents to the idea that a shallow curve of Spee and only a slight incisal overbite are desirable in construction of full upper and lower artificial dentures, it is suggested that a piece of tinfoil about 4 inches square be adapted to the surface of a 12-inch geographical globe and that on this foil a sheet of wax be molded that will enter a vulcanite flask. This is soaped well and invested in half of the flask, with artificial stone or any good model plaster. When it is hard, wax and foil are removed, the plaster surface is soaped and filling of the flask is completed with either plaster or discarded modeling compound.

With this mold and flask press, using a plate cut from a discarded aluminum pot or pan top, templates of various sizes and shapes can be readily swaged.—*W. H. Savage, Clifton Forge, Va.*

Surface Anesthesia—Many patients hesitate to have an anesthetic for operative procedures because of "fear of the needle." Proper use of a surface anesthetic can do much to eliminate this fear. The most economical and satisfactory surface anesthetic is ethylaminobenzoate crystals dissolved in pure ethyl alcohol to make a 10 per cent solution.

The first important point in the application of a surface anesthetic is to see that the site of injection is thoroughly dried. Thorough drying removes any mucin and permits more intense and quicker action of the anesthetic on the surface. For maxillary injections, a cotton roll should be used, and a small pellet of cotton dipped in the solution should be placed under the cotton roll just at the site of injection. The use of a cotton roll prevents the solution from being diluted and at the same time prevents it from running elsewhere in the mouth. For mandibular injections, both cotton rolls and a saliva ejector are used. The mucous membrane is dried carefully and the solution applied.

The second important point is to allow the surface anesthetic to act for fully ninety seconds before attempts at injection. Injecting too soon after applying the solution is the commonest reason for failure of the surface anesthetic to be effective.—*D. Lawrence Harris, 3005 Hennepin Avenue, Minneapolis, Minn.*

Stabilizing the Color in Acrylic Resins—The color of acrylic resins, both for dentures and for jacket crowns, is brought out by vigorous spatulating and mixing while in the plastic stage. Lack of mixing results in greater transparency and darkening of the finished color. Thorough mixing gives greater opacity and a lighter color in the finished acrylic.

The effect of spatulation approaches a limit beyond which no increase in opacity or lightening of color results. This is fortunate, as it enables the dentist to obtain consistent results. The phenomenon is no doubt due to the dispersion of the pigments in the acrylic mass.

In the matching of colors for jacket crowns, both for acrylic and for fused porcelain, in the case of a gray or dark yellow tooth, it should be remembered that the gray or dark component in the natural tooth being matched usually comes from the deeper portion of the tooth. Therefore, it is better to omit the grayness from the finished jacket and then use a gray cement, to assure a good match.—*Alfred T. King, 185 North Wabash Ave., Chicago, Ill.*

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

ALPHA OMEGA FRATERNITY, Baltimore, Md., December 29-31.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, SUBSECTION ON DENTISTRY, Philadelphia, Pa., December 28.

AMERICAN ASSOCIATION OF ORTHODONTISTS, New York, N. Y., May 5-8, 1941.

CHICAGO DENTAL SOCIETY, MIDWINTER MEETING, February 17-20, 1941.

DENTAL PROTECTIVE ASSOCIATION OF THE UNITED STATES, Chicago, Ill., December 16.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

GREATER NEW YORK DENTAL MEETING, Hotel Pennsylvania, New York, December 2-6.

GREATER PHILADELPHIA ANNUAL MEETING, February 4-7, 1941.

NATIONAL BOARD OF DENTAL EXAMINERS, December 2-3.

PAN AMERICAN ODONTOLOGICAL ASSOCIATION, New York, N. Y., December 4.

STATE SOCIETIES

November

Florida, at St. Petersburg (11-13)
Ohio, at Cincinnati (25-27)

February (1941)

Minnesota, at Minneapolis (25-27)

April (1941)

Alabama, at Birmingham (8-10)
Massachusetts (14-17)
Oklahoma, at Oklahoma City (27-30)

May (1941)

Georgia, at Savannah (19-21)
Illinois, at Peoria (12-15)
Louisiana, at New Orleans (1-3)
Missouri, at St. Joseph (4-7)
New Jersey, at Asbury Park (7-9)
Tennessee, at Nashville (12-15)
Virginia, at Old Point Comfort (5-7)

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 16. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

Connecticut, at Hartford, November 19-23. C. G. Brooks, 302 State St., New London, Recorder.

Minnesota, at Minneapolis, December 16-21. Elmer J. Sundby, 805 Medical Arts Bldg., Duluth, Secretary.

New Hampshire, at Manchester, December 12-14. Otis M. Littlefield, 913 Elm St., Manchester, Secretary.

New Jersey, December 9-14. Walter A. Wilson, 148 West State St., Trenton, Secretary.

Pennsylvania, at Philadelphia and Pittsburgh, December 10-14. Reuben E. V. Miller, 61 North Third St., Easton, Secretary.

South Dakota, at Sioux Falls, January 24-27, 1941. C. H. Boyden, Mitchell, Secretary.

Texas, at Dallas, December 9-12. B. Carl Holder, 1009 Nixon Bldg., Corpus Christi, Secretary.

Wisconsin, at Milwaukee, December 16-20. S. F. Donovan, Tomah, Secretary.

ALPHA OMEGA FRATERNITY

THE annual convention of the Alpha Omega Fraternity will be held at the Belvedere Hotel, Baltimore, Md., December 29-31.

EMANUEL HOFFMAN, *Publicity Manager*,
827 West 36th St.,
Baltimore, Md.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, SUBSECTION ON DENTISTRY

THE next annual meeting of the Subsection on Dentistry of the American Association for the Advancement of Science will be held in Philadelphia, December 28. The four dental groups that are recognized by the association as furnishing membership and

program material for this meeting are (1) the International Association for Dental Research (American Division); (2) the American College of Dentists; (3) the American Dental Association, and (4) the American Association of Dental Schools.

PAUL C. KITCHEN, *Secretary,*
Ohio State University,
College of Dentistry,
Columbus, Ohio.

AMERICAN ASSOCIATION OF ORTHODONTISTS

THE thirty-ninth meeting of the American Association of Orthodontists will be held at the Waldorf Astoria Hotel in New York, N. Y., May 5-8, 1941.

MAX E. ERNST, *Secretary,*
1250 Lowry Medical Arts Bldg.,
St. Paul, Minn.

CHICAGO DENTAL SOCIETY MIDWINTER MEETING

THE Seventy-Seventh Annual Midwinter Meeting of the Chicago Dental Society will be held at the Stevens Hotel, February 17-20, 1941. Members of the American Dental Association are invited to attend.

LEO W. KREMER, *Secretary,*
30 North Michigan Ave.,
Chicago, Ill.

DENTAL PROTECTIVE ASSOCIATION OF THE UNITED STATES

THE annual meeting of the Dental Protective Association of the United States will be held at the Palmer House, Chicago, December 16, at 4 p. m.

E. W. ELLIOT, *Secretary,*
55 E. Washington St.,
Chicago, Ill.

GREATER NEW YORK DENTAL MEETING

THE Greater New York Dental Meeting will be held December 2-6 at the Hotel Pennsylvania, New York.

WALTER A. QUINN, *Chairman,*
Press and Publication,
Room 106A,
Hotel Pennsylvania,
New York.

NATIONAL BOARD OF DENTAL EXAMINERS

THE National Board of Dental Examiners will hold its next session for the examination of candidates in Parts I and II, December 2-3, in schools where there are five or more candidates. For information and application, address

MORTON J. LOEB, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

PAN AMERICAN ODONTOLOGICAL ASSOCIATION

THE fourth annual meeting of the Pan American Odontological Association will be held Wednesday evening, December 4, at the Hotel Pennsylvania, New York, N. Y., during the Greater New York Dental Meeting. A dinner will precede the meeting, at which time several important addresses will be delivered. The profession is invited to attend.

RALPH HOWARD BRODSKY,
Executive Secretary,
205 W. 57th St.,
New York, N. Y.

GREATER PHILADELPHIA ANNUAL MEETING

THE Greater Philadelphia Annual Meeting will be held February 4-7, 1941, at the Benjamin Franklin Hotel.

ABRAM COHEN, *Chairman,*
Publicity Committee,
269 South 19th St.,
Philadelphia, Pa.

ALABAMA DENTAL ASSOCIATION

THE seventy-second session of the Alabama Dental Association will be held at the Tutwiler Hotel, Birmingham, April 8-10, 1941, celebrating the centennial of the world's first dental law, which was enacted in Alabama in 1841.

GEORGE W. MATTHEWS, *Secretary,*
905 Protective Life Bldg.,
Birmingham.

GEORGIA DENTAL ASSOCIATION

THE seventy-third annual meeting of the Georgia Dental Association will be held at Savannah, May 19-21, 1941, with headquarters at the Hotel DeSoto.

R. H. MURPHY, *Secretary,*
Macon.

ILLINOIS STATE DENTAL SOCIETY

THE next annual meeting of the Illinois State Dental Society will be held in Peoria,

May 12-15, 1941. The newly elected officers are: John J. Donelan, Springfield, president; J. R. Blayney, Chicago, president elect; J. Leslie Lambert, Springfield, vice president; L. H. Jacob, Peoria, secretary, and R. W. McNulty, Chicago, treasurer.

L. H. JACOB, *Secretary,*
Jefferson Building,
Peoria.

LOUISIANA STATE DENTAL SOCIETY

THE sixty-first annual meeting of the Louisiana State Dental Society will be held May 1-3, 1941, at the Roosevelt Hotel, New Orleans.

JULIAN S. BERNHARD, *Secretary,*
417 Medical Arts Bldg.,
Shreveport.

MASSACHUSETTS DENTAL SOCIETY

THE Massachusetts Dental Society will meet April 14-17, 1941.

PHILIP E. ADAMS,
106 Marlboro St.,
Boston.

MINNESOTA STATE DENTAL ASSOCIATION

THE fifty-eighth annual session of the Minnesota State Dental Association will be held in the Municipal Auditorium, Minneapolis, February 25-27, 1941.

L. M. CRUTTENDEN, *Secretary,*
498 Lowry Medical Arts Bldg.,
St. Paul.

MISSOURI STATE DENTAL ASSOCIATION

THE Missouri State Dental Association will hold its next meeting in St. Joseph, May 4-7, 1941.

C. W. DIGGS, *Secretary,*
Exchange National Bank Bldg.,
Columbia.

NEW JERSEY STATE DENTAL SOCIETY

THE next annual meeting of the New Jersey State Dental Society will be held in Asbury Park, May 7-9, 1941, at the Berkeley Carteret Hotel.

F. K. HEAZELTON, *Secretary,*
223 E. Hanover St.,
Trenton.

OHIO STATE DENTAL SOCIETY

THE seventy-fifth annual meeting of the Ohio State Dental Society will be held at the Netherland Plaza Hotel, Cincinnati, November 25-27, celebrating its Diamond Anniversary. November 24, the building in Bainbridge in which John Harris held his school in 1827 will be dedicated. A meeting of the House of Delegates of the state society will follow. Bus transportation will be arranged to return to Cincinnati for the Component Society Officers' Conference and dinner. The dedication at Bainbridge will be an outstanding event in the history of the profession and a large representation is expected.

EDWARD C. MILLS, *Secretary,*
255 E. Broad St.,
Columbus.

OKLAHOMA STATE DENTAL SOCIETY

THE next meeting of the Oklahoma State Dental Society will be held in Oklahoma City, April 27-30, 1941.

O. W. BOYER, *Secretary,*
Perry.

TENNESSEE STATE DENTAL ASSOCIATION

THE seventy-fourth annual meeting of the Tennessee State Dental Association will be held at the Hotel Andrew Johnson, Knoxville, May 12-15, 1941.

HOWARD M. TAYLOR, *Secretary,*
206 Medical Arts Bldg.,
Knoxville.

VIRGINIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Virginia State Dental Association will be held at the Chamberlain Hotel, Old Point Comfort, May 5-7, 1941.

J. E. JOHN, *Secretary,*
Medical Arts Bldg.,
Roanoke.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

THE next examination by the Board of Dental Examiners of California for license to practice dentistry and for license to practice dental hygiene in California will be given in San Francisco, commencing December 16, at the College of Physicians and Surgeons, College of Dentistry, San Francisco, and at the University of California, College of Dentistry, San Francisco. All credentials must be in the office

of the secretary at least twenty days prior to the date of examination. Address all communications to Kenneth I. Nesbitt, Secretary, Board of Dental Examiners of California, Room 203, 515 Van Ness Ave., San Francisco.

CONNECTICUT DENTAL COMMISSION

THE Connecticut Dental Commission will meet in Hartford, November 19-23, for the examination of applicants for license to practice dentistry or dental hygiene and to transact any other business proper to come before it. Applications should be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to

C. G. BROOKS, *Recorder*,
302 State St.,
New London.

MINNESOTA BOARD OF DENTAL EXAMINERS

THE Minnesota State Board of Dental Examiners will hold its next examination December 16-21 at the School of Dentistry, University of Minnesota, Minneapolis.

ELMER J. SUNDBY, *Secretary*,
805 Medical Arts Bldg.,
Duluth.

STATE OF NEW HAMPSHIRE DENTAL BOARD

THE New Hampshire State Dental Board will hold examinations, December 12-14, at Manchester.

OTIS M. LITTLEFIELD, *Secretary*,
913 Elm St.,
Manchester.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations, commencing December 9 and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules, instruction sheet and preliminary application blank will be sent. Any person desiring to apply as a candidate must file the preliminary application blank, together with the examination fee of $25, on or before March 15 for the succeeding June examinations or before September 1 for the succeeding December examinations.

WALTER A. WILSON, *Secretary*,
148 West State St.,
Trenton.

DENTAL COUNCIL AND EXAMINING BOARD OF THE COMMONWEALTH OF PENNSYLVANIA

THE Dental Council and Examining Board of the Commonwealth of Pennsylvania will conduct examinations in Philadelphia and Pittsburgh, December 10-14. For information and application blanks, address the Department of Public Instruction, Bureau of Professional Licensing, Dental Division, Harrisburg, or

REUBEN E. V. MILLER, *Secretary*,
61 North Third St.,
Easton.

SOUTH DAKOTA BOARD OF DENTAL EXAMINERS

THE South Dakota State Board of Dental Examiners will hold its next examination at the Carpenter Hotel, Sioux Falls, January 24-27, 1941. Applications should be in the hands of the secretary ten days before the date of the meeting. For further information, address

C. H. BOYDEN, *Secretary*,
Mitchell.

TEXAS BOARD OF EXAMINERS

THE Texas Board of Dental Examiners will hold its next examination December 9-12 in Dallas. Applications must be filed at least ten days prior to the date of examination. For further information, address

B. CARL HOLDER, *Secretary*,
1009 Nixon Bldg.,
Corpus Christi.

STATE OF WISCONSIN BOARD OF DENTAL EXAMINERS

THE Wisconsin Board of Dental Examiners will hold its next meeting at the Marquette Dental School, Milwaukee, to examine applicants for license to practice dentistry and dental hygiene December 16-20. Applications and required fee must be in the hands of the secretary not later than December 10. Address all communications to

S. F. DONOVAN, *Secretary*,
Tomah.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A COMPETITIVE examination to select can

didates for appointment in the Dental Corps of the Navy will be held December 2 at the Naval Medical School, Washington, D. C., Naval Training Station, Great Lakes, Ill., and Naval Training Station, San Diego, Calif. A candidate for appointment in the Dental Corps must be a citizen of the United States, between 21 and 32 years of age at the time of appointment, and a graduate of a standard dental college. A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

DENTAL INTERNSHIPS

APPLICATIONS for dental internships are now being received at the Baltimore (Md.) City Hospitals. Senior students interested can obtain application blanks by writing to the superintendent, Baltimore City Hospitals, 4940 Eastern Ave., Baltimore, Md. Applications should be in by February 1, 1941.

P. J. MCMILLIN, *Superintendent.*

POSTGRADUATE COURSE OFFERED BY NEW YORK UNIVERSITY COLLEGE OF DENTISTRY

A COURSE in fixed bridge construction will be given at the New York University College of Dentistry, Friday afternoons, 2:30-7:30 p.m., January 31-March 28, 1941; tuition $1.00, class limited to sixteen members. This course will deal purely with the principle of complete fixation for stabilization of all fixed bridge construction, covering, by means of lectures, lantern slides, and motion pictures (in color and animation), the following subjects in detail: diagnosis, principle of parallelism, treatment planning, cavity preparation and pontic construction. The clinical procedure will be performed on the patients by the postgraduate students, the patients to be supplied by the college. The following aspects of clinical procedure will be taught: full mouth hydrocolloid-compound impressions, equilibration of occlusion, finishing and polishing of bridges, sterilization of abutment teeth and the final cementation of the completed work.

For further information, address the office of the dean, New York University, College of Dentistry, 209 East 23d St., New York, N. Y.

REGIONAL POSTGRADUATE COURSE IN CHILDREN'S DENTISTRY

BEGINNING November 1, regional postgraduate courses in pedodontia will be offered the dentists of Indiana. These courses will be sponsored by the Dental Division of the Bureau of Maternal and Child Health, Indiana State Board of Health, cooperating with the Indiana University School of Dentistry and the Indiana State Dental Association.

Since 1937, similar courses have been offered by the dental division and held at the Indiana University Dental School in Indianapolis. Favorable comments have been received from the men who availed themselves of these courses. This year, extramural or regional courses are being planned, consisting of a series of programs carried out over a period of from four to six weeks and consuming an afternoon and evening or an evening once a week during that period.

Regional courses in children's dentistry will make it possible for a greater number of dentists to receive the newest, accepted information on preventive care and treatment as relates to pedodontia. This type of program will also make it possible for more dentists to offer a complete service to their patients and thus raise the standards of dental care for children in the state.

The program will include one week's instruction in each of the following subjects: dentistry and public health, child management, preventive dentistry, operative dentistry for children, and extractions and surgical procedures for children.

It is hoped that dentists will take advantage of this opportunity. A limited number of these courses are to be offered, and those regional groups applying first will be given first choice. All requests should be directed to the Dental Division, Bureau of Maternal and Child Health of the Indiana State Board of Health, Indianapolis, Ind.

CIVILIAN DENTISTS WANTED FOR DUTY WITH CIVILIAN CONSERVATION CORPS

A NUMBER of vacancies will exist in the Civilian Conservation Corps in the Eighth Corps Area wherein the services of dentists can be utilized as civilian employes (dentists) or as contract dentists. Applicants must be graduates of Class A dental schools.

Applications should be addressed to the Surgeon, CCC, Headquarters Eighth Corps Area, Fort Sam Houston, Texas. Consideration will be given to applicants as follows:

1. Dental Reserve Corps officers can be placed on duty under Classification P-2 at the initial rate of pay of $2,600 a year.

2. Dentists who are not members of the Dental Reserve Corps can be placed on duty as contract dentists at the initial rate of pay of $2,600 a year.

Both of the above-mentioned groups must consider themselves physically qualified and, if selected, they must report to their first place of assignment at their own expense. If found physically qualified at that time, they will be appointed at the respective rates. Upon being relieved from duty either at their own request or for the convenience of the government, the dentist must bear the expense of return transportation.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING SEPTEMBER 1940

September 3

No. 2,213,865, THEODOR KOCH and OTTO W. LANGHANS. Method of welding solder to a tooth pin.

September 10

No. 2,213,963, SIMON MYERSON. Artificial tooth and method of making same.

No. 2,213,964, SIMON MYERSON. Artificial tooth.

No. 2,214,316, ROBERT C. ANGELL. Dental equipment assemblage.

No. 2,214,407, AUGUST ANDREAS DEUTSCH. Toothbrush with brush head made in three parts.

No. D-122,382, WILLIAM T. BRENNAN and WILLIAM P. KENNEDY. Design for rotary toothbrush extension.

No. D-122,388, MAXIMILIAN COHEN. Design for combination toothbrush and dental mirror.

No. D-122,500, EDWARD G. NORTON. Design for toothbrush.

September 17

No. 2,214,774, ALPHONSE F. PIEPER. Unitary dental apparatus.

No. 2,214,775, ALPHONSE F. PIEPER. Unitary dental apparatus.

No. 2,215,031, NEAL ELMORE. Motor driven toothbrush.

No. 2,215,222, DUDLEY D. LEVY. Dental tool holder.

September 24

No. 2,215,479, JACOB A. SAFFIR. Device for preserving local anesthetic solution.

No. 2,215,666, CHARLES R. MEITZLER. Extensible chair.

No. 2,216,026, FLORENCE SMITH. Pocket folding toothbrush.

No. D-122,717, JOHN W. CHRISTENSEN. Design for dentist's cabinet or the like.

No. D-122,723, JOHN A. KORENGOLD. Design for a surgical illuminating unit or similar article.

No. D-122,737, ALFRED A. EINZIG. Design for dental accessories container.

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